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Greater Egypt Region Solid Waste Management System Analysis

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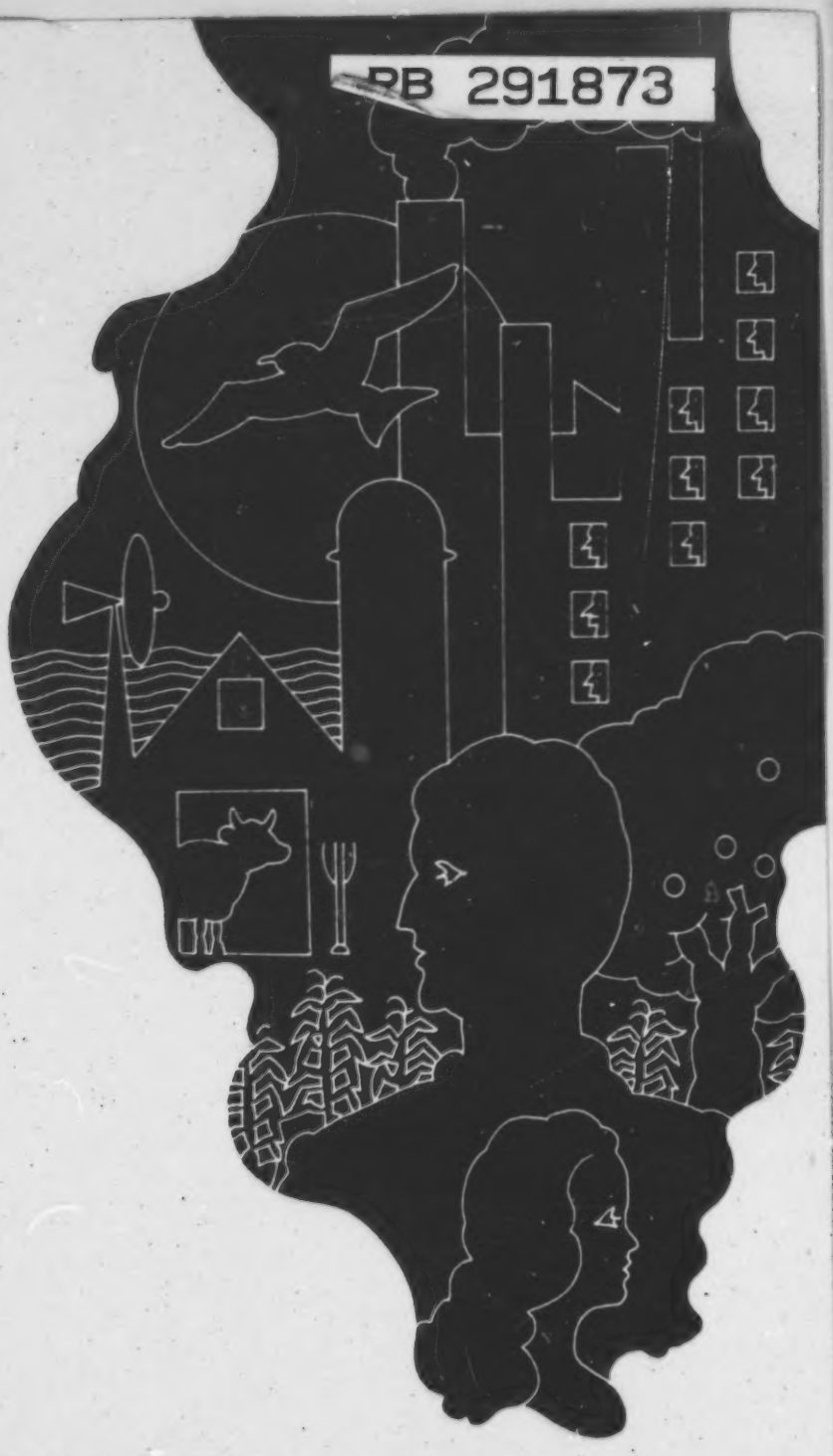

GREATER EGYPT REGION
SOLID WASTE MANAGEMENT SYSTEM ANALYSIS

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SOLID WASTE MANAGEMENT
SYSTEM ANALYSIS

Roy F. Weston, Inc.

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The Need for Advance Planning in Illinois

In July, 1970, the Illinois General Assembly passed the Illinois Environmental Protection Act. This law expresses the determination of the people to improve the quality of the environment in Illinois. The Act addresses problems of air, water, land and noise pollution.

In 1973, the Illinois Pollution Control Board adopted new regulations for sanitary landfills. These regulations are enforced by the Illinois Environmental Protection Agency. The permit and inspection provisions established under these regulations are among the most comprehensive and vigorous in the United States. Each landfill operator is required to apply for a permit by April 27, 1974. The expense of meeting Illinois design and operating standards has and probably will cause some marginal landfill operations to close, thereby eliminating some environmentally unacceptable, but convenient, disposal sites.

The dwindling number of solid waste disposal sites has caused concern among municipal officials and private solid waste companies. Efforts to aquire new sites have often been thwarted by citizens who recognize the need for such facilities, but would rather see them located somewhere else.

The increased costs associated with everything these days have strained municipal budgets. Solid waste management is a large budget item. Elected officials are asking: Can this be reduced?

Over half of the solid waste in Illinois is managed by private companies. Their costs are increasing, and so are the rates charged to their clients. Public officials are asking: What is the cost of solid waste management? Should we go into business for ourselves?

In 1973, the energy crisis reinforced the long-standing argument by

environmentalists that something should be done to recover the resources going into solid waste. Solid waste managers now must cope with the added complexities of unproven recovery systems and an uncertain market for recovered commodities.

These and other pressing problems require planning. This study provides a basis for that planning by examining the economics of current solid waste management practices and proposed regional management strategies.

State Solid Waste Plan

The State Solid Waste Management Planning Project will examine the solid waste needs of Illinois and make recommendations as to actions that can be taken by the State to improve solid waste management generally. The Solid Waste Management Task Force of the Illinois Institute for Environmental Quality recognized from the start that solid waste management is a local responsibility and is subject to the specific desires of the people as to the services desired and the manner of satisfying these desires. Consequently, the task force suggested that the principal thrust of the State planning project should be to assist the work of local and regional planners who must prepare the specific recommendations for local officials.

This report is an analysis by the State and its consultants of several alternatives available to a specific region. Basic data used in the analysis was gathered by the regional planners, processed by the consultants, and rechecked by the regional planners. Elsewhere in the State plan, the planner will find reference data on the natural features of the State which will have an impact on solid waste management activities.

The Analytical Process

People and their activities produce solid waste. The first step in the planning procedure was to determine population and employment. Basic population projection data was generated by Argonne National Laboratory using historic census data and a predictive model. These projections were checked by the regional planner using local data and projections by the Illinois Office of Planning and Analysis (OPA). Tables 1 and 3 show examples of population and employment projections. Employment data was taken from the

Table 1

PROJECTED POPULATION EXAMPLE

LOCATION	1970	1975	1980	1985	1990	1995	2000
City A	305	305	350	360	390	400	410
City B	39,992	44,500	48,500	51,400	54,000	57,100	59,800
City C	2,435	2,780	3,010	3,230	3,440	3,690	3,910
City D	26,396	27,900	34,400	39,100	43,800	49,000	54,100
SUB TOTAL	69,128	75,385	86,260	94,030	101,630	110,190	118,220
UNINCORPORATED	21,754	23,400	24,200	24,800	25,300	25,900	26,400
COUNTY TOTAL	90,882	98,785	110,460	118,890	126,930	136,090	144,620

Table 2

AN ILLUSTRATION METHOD OF MUNICIPAL SOLID WASTE GENERATION

(1) Political Subdivision	(2) 1970 Population	(3) Area, $(mi.^2)$	(4) Population Density (2) ÷ (3)	(5) Log (4)	(6) 1.54 X (5)	(7) Generation Factor (6) - 0.68 #/cap./day	(8) Collection Rate (2) x (7) #/day	(9) Collection Rate (8) ÷ 285.7 ton/week
City A	305	0.17	1,794	3.25	5.01	4.33	1,320	4.6
City B	39,992	11.37	3,517	3.55	5.46	4.78	191,161	699.
City C	2,435	1.28	1,902	3.28	5.05	4.37	10,641	37.
City D	26,396	6.06	4,356	3.64	5.60	4.92	129,868	455.
Co. Remainder	21,358	1,157.	18.7	-	-	3.4	72,617	254.

Table 3

AN EXAMPLE OF THE EMPLOYMENT PROJECTIONS

SIC		1971	1975	1980	1985	1990	1995	2000
City B	207	1,000	1,000	1,000	1,000	1,000	1,000	1,000
	2432	25	29	31	35	36	40	42
	3272	3	0	0	0	0	0	0
	358	1,500	2,470	2,750	3,020	3,220	3,630	4,010
City C	243	15	15	15	15	15	15	15
	271	4	1	0	0	0	0	0
City D	275	15	21	27	32	37	43	49
	278	60	79	100	140	170	210	240
	301	225	225	225	225	225	225	225
	327	32	32	35	35	35	35	35

Illinois Manufacturers' Association Directory as an historic data base. Employment projections are expressed in 3- and 4- digit Standard Industrial Classification (SIC) code (Table B-1, Appendix B).

Approved population projections are then multiplied by waste generation factors to give the municipal solid waste load (i.e. the residential and commercial wastes generated within a community).

Table 2 is an example of a tabular solution in which population is translated into a solid waste generation rate. (A more detailed explanation of the columns and the computational method is contained on Page B-1, Appendix B). Similarly, Table 4 gives a sample calculation in which employment is translated into tons of industrial wastes. The conversion factors (Table B-1, Appendix B) for converting employment data into tons of waste were derived by the consultant from data supplied by the USEPA. Table 5 shows, where there is no centrally located municipality, how the residential waste from unincorporated areas is allocated (on the basis of percentage of area) and combined with municipal and industrial wastes for the purpose of subsequent analyses. Wastes from unincorporated areas are considered to be located at the centroid of the township.

For long-term planning, consideration must be given to the annual change in generation rates. The computational methodology is shown on Table 6. A 2% and 3% per year increase in the generation factor was used for cities with more than 10,000 people and less than 10,000 people respectively.

Total waste quantities for the present (1973) and a future date (1990) are presented on Table 7. These waste quantities are, in turn, provided as input to a computerized model. The computer then determines the cost of hauling waste from the centroid of each source to each specified processing or disposal site. Transportation costs are added to site annual operating costs to determine a total annual system cost. It is within the capability of the computer model, if it is so instructed, to select the combinations of sources, processing facilities and ultimate sites which given the least (optimum) system cost.

Table 4

EXAMPLE OF INDUSTRIAL WASTE LOADING CALCULATION

(1) Location of Political Subdivision	(2) SIC Code	(3) Number of Employees in 1971	(4) Generation Factor (Ton/Empl/Yr)	(5) Production Rate (Ton/Yr) (3) x (4)	(6) Production Rate (Tons/Week) (5) ÷ 52	(7) Total Industrial Waste For Each Source (Ton/Week)
City A						0
City B	207	1,000	3.3	3,300.	63.4	
	2432	25	232.	5,800.	111.5	
	3272	9	154.	1,310	26.1	
	358	1,500	1.5	2,250	42.2	243.2
City C	243	15	21.7	3 325.5	6.3	6.3
City D	275	15	1.1	16.5	-	
	278	60	2.6	156.	3	
	301	225	3.7	833.	16	
	327	32	15.	480.	9.2	28.2

Table 5

EXAMPLE OF COMPOSITE LOADING SHEET FOR BASE YEAR - 1973

Source Name	I.D#	SIC Load (Ton/Week)	Municipal Load (Ton/Week)	Area for Division of County Remainder $(Miles)^2$	Load due to County Remainder (Ton/Week)	Total Load (Ton/Week)
City A	101	-	4.6	9.7	54.6	59.2
City B	102	243.2	699.	10.	56.3	998.5
City C	103	6.3	37.	10.4	58.6	101.9
City D	104	28.2	455.	15.	84.5	567.7
				45.1	253.98	
County Remainder -		-	254			1727.3

Table 6

AN EXAMPLE OF THE COMPOSITE SHEET FOR WASTE LOADS (Ton/Week) FOR 1990

Source Name	I.D.#	1990 Industrial Load (Ton/Week)	1970 Generation Rate (#/cap./day)	% Increase Per Year	Total % Increase	1990 Generation Factor (#/cap./day)	1990 Municipal Waste Loads (Ton/Week)	County Area Factor	County Remainder Based on Area (Ton/Week)	1990 Total Waste Loads (Ton/Week)
City A	101	-	4.33	3	60	6.9	9.4	36	94.3	103.7
City B	102	360	4.78	2	40	6.35	1264.	48	125.7	1389.7
City C	103	6	4.37	3	60	6.99	84.3	64	167.7	252.
City D	104	36	4.92	2	40	7.87	1207.	36	94.3	1301.3
County Remainder			3.4	3	60	5.44	482	184		3046.7

Table 7

EXAMPLE OF THE STUDY PERIOD SOURCE INVENTORY

SOURCE NAME	SOURCE ID NO.	1973 VALUES QUANTITY (Tons/Week)	1990 VALUE QUANTITY (Tons/Week)
City A	101	59.2	103.7
City B	102	998.5	1389.7
City C	103	101.9	252.
City D	104	567.7	1301.3

In addition to sources and waste quantities, the computer must be given cost parameters for transportation and for the operation of the solid waste management system specified. Unit costs for the disposal systems tend to be lower as the quantities increase. Such variable cost factors are best described by cost curves which were incorporated into the computer input. These cost curves are shown in Figs. B-1 and B-2, Appendix B.

In developing the planning factors and cost curves, the consultant was faced with the problem of picking a finite value for a given function when, in actuality, that function could be described by a range of values. The values given here are neither the highest nor the lowest, but an estimate of current conditions. They were adjusted to 1973 cost levels using the Engineering News-Record construction cost index. Where appropriate, assumptions are listed.

Computations do not include the cost of solid waste collection. It is assumed that, regardless of the management system used, the waste must be collected. Whether it is collected once a week or twice a week, at the curb or at the back door, in plastic bags or in 32 gallon cans, are matters of local preference. The alternatives addressed in this study include the cost of moving from the centroid of the collection area to an intermediate or final disposal site.

Aside from taking the drudgery out of the thousands of calculations required, the computerized model permits the planners to examine a range of management alternatives. The strategies thus examined and reported here were proposed and analyzed by the regional planner with assistance from the State's consultants.

Resource Recovery

These analyses take a conservative view of the economics of resource recovery alternatives. As of March, 1974, there were no large scale resource recovery systems operating in the United States. Certain demonstrations projects are operating successfully in Franklin, Ohio and St. Louis, Missouri. Larger systems have been designed and several are under construction. We can

predict operating and capital costs better than we can predict the off-setting revenues from the sale of recoverable resources. Table 9 gives recent prices for the secondary materials present in typical municipal waste. These prices are subject to the usual variations of the commodities market, as well as regional variations in transportation costs. Table 10 describes eight levels of resource recovery activities and the expected revenue (based on Table 9 prices). The decision to adopt a resource recovery system will entail an evaluation of the risk involved in the fluctuating market values.

Uses of This Report

The results of this analysis are intended to assist the regional planner in preparing recommendations for local decision makers. The analytical techniques used are based upon averages and generalized planning factors developed in 1973 and cannot be expected to reflect the exact local cost situation. The usefulness of this regional analysis is to show the relative economic merits of alternate management systems, thus enabling the planner to separate the most feasible alternatives from the least feasible.

This report includes basic data, planning factors, and sample calculations so that the regional planner can make specific adjustments later on. It is to be emphasized that the least cost solution is not necessarily the best. The recommended solution will be that which combines economy with regional desires and constraints. To prepare such recommendations is the task of the regional planner.

Future Planning

It is expected that regional planners will need to up-date their plans and to consider other strategies. It is the intention of the Illinois Institute for Environmental Quality to maintain the capability for providing these regional analyses.

TABLE 9

RESOURCE RECOVERY VALUE FOR FERROUS AND NONFERROUS METALS, GLASS, FIBERS AND HEAT VALUE

Materials Recovered	Conc. In MSW (%)	Recovery (%)	T /100T MSW	Delivered Price	Trans. Charge (5)	Net Credit	Credit $/Ton Of Input Solid Waste
Ferrous Metal (6)	7.5	100	7.5	$56	$ 46	$11.7	$ .82
#2 Bundle	7.5	100	7.5	20 (10-30)	6	10	0.75
Madison (3)	7.5			51	6	14	1.05
Scrap Steel Jan. 73 (4)				86	6	45	
Jan. 74 (4)						80	
Scrap Steel Incinerator Residue			7.5	12 (10-14)	5	7 (5-9)	.53 (.40-.72) (.42 (6))
Aluminum	1.0	100	1.	200	50	150	1.50
Copper Zinc Fraction	.5	100	.5	240	50	190	.95
Copper Scrap (Jan. 73) (4)				860	50	810	
(Jan. 74) (4)				1360	50	1310	
Tin Scrap (Madison (3))				4000	50	3950	
Glass (Sorted by color)	9.	44	4.	16	6	10	.40
Mixed Glass Fines	9.	70	6.3	5	6	- 1	-0.06
Fourth Forest Pulp	40. (Dry Basis)	45	18.	25	8	17	3.06
Newsprint (July 73) (4)			8	18	8	10	0.80
(Nov. 73) (4) Separated			8	35	8	27	2.16
(Jan. 74)			8	60	8	52	4.16
Paper (6)			15.			15	2.25
Energy Recovery							
Electric Energy (6)			6.67×10^4 Kwhr.			$.006/Kwhr.	4.00
Shredded Refuse Heat Value (7)			7.5×10^8 Btu/100 Ton			.50¢/M Btu	3.75
Total Combustible	75. (Wet Basis)	100	75.			(1.)	4.95
Combustible After Fiber Recovery	75. (Wet Basis)	66	50.			(2.)	3.3
Synthetic Fuel Oil (6)			4.80×10^8 Btu/Ton			$.8-/10^6$ Btu	3.36
Synthetic Fuel Gas (6)			6.7×10^8 Btu/Ton			$.50/10^6$ Btu	3.33
Steam			175	1.90 @ .95/1000#			3.33
			175				

1. Produces 450 Kilowatts-hours of Electricity/Ton, Valued at 1.1 Cent per Kilowatt-hours.
2. Producers 300 " " " " " " " " " " " "
3. From Madison Wisconsin Shredding and Landfill Operation.
4. Wall Street Journal - January 31, 1974
5. Transport Cost for 1973 Average Used Through-out, Value Fluctuates
6. Resource Recovery - The State of Technology, pg. 25
7. Commonwealth Edison 1974

This Table summarizes the by-product credits that may be realized by reclamation of recyclable materials from a ton of MSW. The credits reflect 1973 conditions and assume reasonable transportation charges to proximate recycling plants; i.e., the credits are based on delivered prices and representative concentrations of the salvaged materials in MSW. Extreme fluctuation can be seen in a one year period. Selection of appropriate value must be based on transport distance and market demand.

Table 10

TABLE OF RESOURCE RECOVERY VALUES FOR VARIOUS SYSTEMS

A. Small operation - magnetic separation of cans
$1.05/Ton of Input Municipal Solid Waste (M.S.W.)

B. Cans and Paper Recovered
$1.05 Cans
3.06 Paper - based on separate collection
$4.11/Ton of Input M.S.W.

C. Cans, Paper, Aluminum, Copper - Zinc Fraction Recovered
$1.05 Cans
3.06 Paper - separate collection
1.50 Aluminum
.95 Copper - Zinc Fraction
$6.56/Ton of Input M.S.W.

D. Cans, Paper, Aluminum, Copper-Zinc, and Fraction Heat Recovery
$1.05/T for Cans
3.06/T for Paper separate collection
1.50/T for Aluminum
.95/T for Copper-Zinc Fraction
3.00/T for Heat Recovery after Fiber Recovery
$9.56/Ton M.S.W. Input

E. Incineration with Residue Recovery. Recover only Steel Cans
$ .53 Cans from incinerator Residue

$ .53/Ton M.S.W

F. Metal Recovery, Heat Recovery, Heat Recovery of Shredded M.S.W.
$1.05/T for Magnetic can separation
1.50/T for Aluminum
.95/T for Copper-Zinc Fraction
3.75/T for Shredded Fuel Value

$7.25/T of Input M.S.W.

G. Incineration with Residue Recovery and Heat Recovery
$ .53/T for Cans from incinerator Residue
1.50/T for Aluminum
.95/T for Copper-Zinc Fraction
4.50/T for Heat Value

$8.00/T for Heat and Material Recovery of M.S.W.

H. Source separation and separate collection of newsprint
$ .80-4.16/Ton of input Municipal Solid Waste (M.S.W.)

CAUTION: This table shows the value of recovered resources for 8 theoretical recovery systems. It is based on the "credit $/Ton" column of Table 9, and is subject to the conditions and assumptions stated. Tables 9 and 10 may need to be modified to reflect local markets and transportation costs.

Management Alternatives for the Greater Egypt Region

A report published by the Greater Egypt Regional Planning Commission in 1969 listed the following major solid waste problems:

-An established tradition of small, community dumps, most of which do not meet environmental standards.

-Small communities and unincorporated areas with no solid waste management services.

-Counties which lack the financial measures or the taxing power to provide the services which the cities can provide for themselves.

-Promiscuous dumping on rural land and along the roadside.

-Unsightly recreation areas.

The study evaluated two alternatives:

-Separate landfills operated by each county.

-City-operated landfills, for which the county paid a dumping fee for wastes from unincorporated areas.

The cost of landfilling at that time was estimated at $1 per ton.

Present Problem

In the five years since the original study, Illinois has acquired an Environmental Protection Act and more stringent regulations governing sanitary landfills. All landfills in the state will be required to have an operating permit by July 27, 1974

The Greater Egypt Regional Planning Commission has identified 27 landfills within regional boundaries. Six additional sites were added from IEPA records. Of this list of 33 facilities, 20 were selected for analysis based upon their operating capacity and useful life. As of June, 1974, only 8 of these landfills have initiated action to obtain an operating permit. Obviously, some of the 20 existing facilities will be closed in the future, for various reasons. The question then becomes: what will be the impact of these closures on the existing waste management system?

How many landfills are needed? and, where should they be located?

The purpose of this study is to analyze the cost of several alternative systems in an effort to find answers to the above questions. The analysis will consider both short and long-term implications.

Computational Methods

Projections of population and employment were calculated using the method described in Chapter 1. The results are tabulated in Tables A-1, A-2, A-3 and A-4 in Appendix A. A summary of geological information for each county within the Greater Egypt Region indicates soil and groundwater conditions and the possible impact on landfilling operation.

Short-Term Analysis

For the purposes of this study, a short-term alternative is one that can be implemented within 2 to 3 years. The basis for comparison is the existing regional system.

Alternative 1 describes the existing system. Table 2-1 identifies the waste sources. The diagram on page 15 relates each waste source to a disposal site. The diagram on page 16 displays the disposal system for the congested areas. The general cost information given on page 15 is the total system cost as computed by the model.

The existing system unit cost ($8.40/ton) includes the round-trip haul from the last collection stop to the disposal facility, plus the cost of operating the disposal facility. An examination of the diagram suggests that there are too many landfills in the system and that haulers are not always using the nearest landfill facility.

Table 2-1

Sources and Identification Numbers for Greater Egypt

101	Sesser
102	Rend Lake T
103	Ewing
104	Macedonia
105	Valier
106	North City
107	Christopher
108	Buckner
109	West City
110	Benton
111	Havaford
112	Akin T
113	Royalton
114	Ziegler
115	Orient
116	West Frankfort 1
270	West Frankfort 2
117	Thompsonville
118	Campbell Hill
119	Ava
120	Sato T
121	Vergennes
122	Dowell
123	Elkville
124	Jones Ridge T
125	Kinkaid T
126	Levan T
127	Summerset T
128	DeSoto
129	Jacob T
130	Gorham
240	Grand Towers
241	Mona T
242	Makanda
131	Murphysboro N.E.
132	Murphysboro N.W.
133	Murphysboro S.E.
134	Murphysboro Southwest
135	Carbondale West
136	Carbondale Northeast
137	Carbondale Northwest
138	Carbondale Southeast
139	Carbondale Southwest
140	Grande T
141	Dix
142	Texico T
143	Farrington T
144	Woodlawn
145	Shiloh T
146	Mount T
147	Bluford
148	Blissville T
149	McClellan T
150	Dodds T
151	Belle Rive
152	Waltonville
153	Nason
154	Ina
155	Bonnie Pop
156	Moores T
157	Mt. Vernon 1
158	Mt. Vernon 2
159	Mt. Vernon 3
160	Stanwick T
161	No. 4-3 T
162	No. 4-2 T
163	Tamaroa
164	Jamestown T
165	Pinckneyville
166	No. 5-2 T
167	No. 1 T
168	Cutter
169	Willisville
170	No.6-3 T
171	No.6-2 T
172	St. Johns
173	DuQuoin
180	Bush
181	Hurst
182	Colp
183	Cambria
184	Freeman-spur
385	Herrin -Northeast
185	Herrin
186	Energy
187	Johnston City
188	Whiteash
189	Pittsburg
190	Corinth T
191	Carterville
192	Grainsville
293	Marion Northeast
193	Marion Central
294	Marion Southwest
194	Spillerton
195	Bankston T
196	Devils Kitchen T
197	Federal Prison T
198	Creal Spring
199	Stonefort

Table 2-2

Ultimate Facilities For The Greater Egypt Region

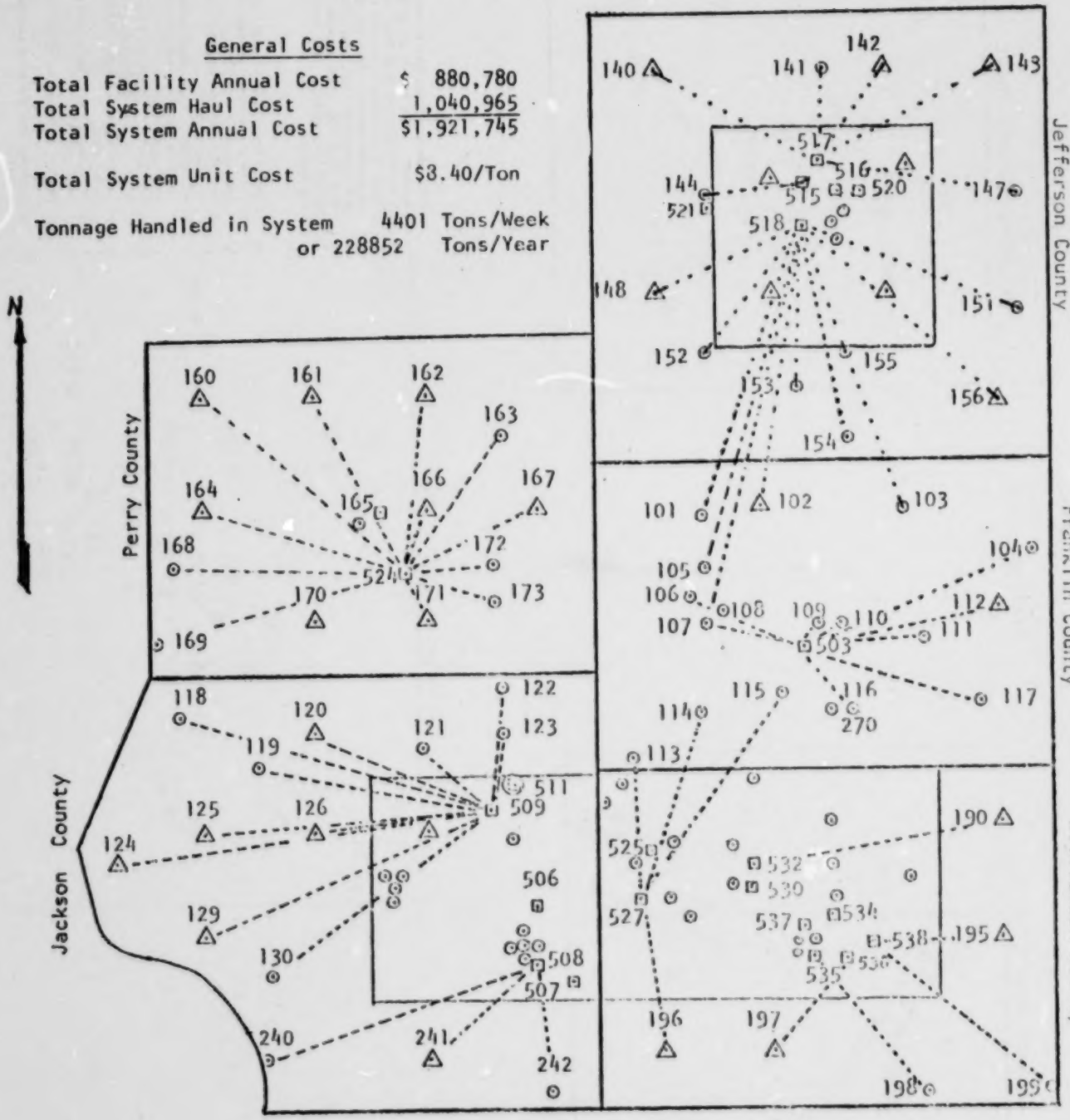
Site I.D. #	Name
503	Benton-Vise Brothers
506	Carbondale Municipal
507	Carbondale Municipal
508	Carbondale-Young
509	Desoto-Bryant
511	Dèsoto-Gray Recycle
515	Mt. Vernon-Eller
516	Mt. Vernon - L & M
517	Mt. Vernon - McDermot
518	Mt. Vernon - Municipal #2
520	Mt. Vernon - Thompson
524	DuQuoin - Municipal
525	Blairsville
527	Carterville
530	Herrin #3
532	Herrin Municipal
534	Marion Municipal
535	Marion Demolition
536	Marion Parks
538	Marion Norris

GREATER EGYPT Regional Planning Area

Cost of Existing System Based on Available Date, 1973-1974 - Alternative #1

General Costs

Total Facility Annual Cost	$ 880,780
Total System Haul Cost	1,040,965
Total System Annual Cost	$1,921,745
Total System Unit Cost	$8.40/Ton
Tonnage Handled in System	4401 Tons/Week
or	228852 Tons/Year



General Haul Cost Assumptions

Packer Haul Cost - $4.36/Ton-Hr.

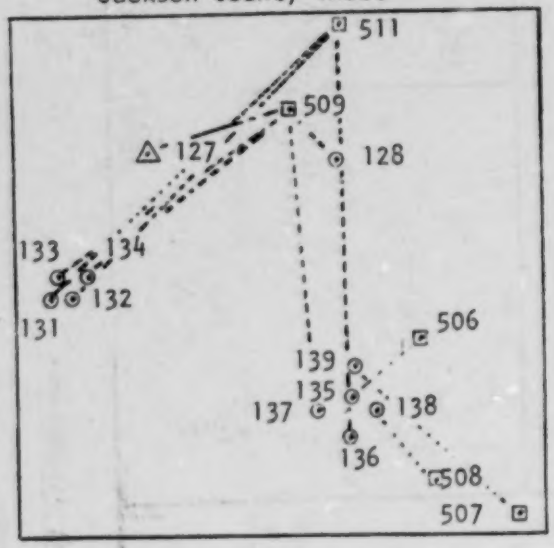
Transfer Haul Cost - $1.40/Ton-Hr.

GREATER EGYPT PLANNING REGION

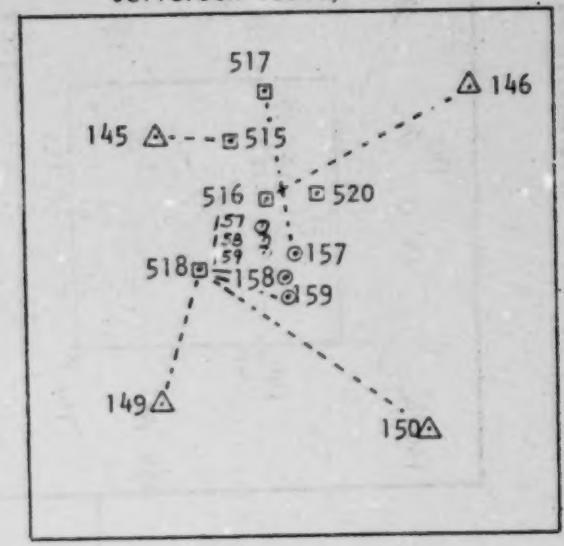
Congested Area Insets

Alternative I

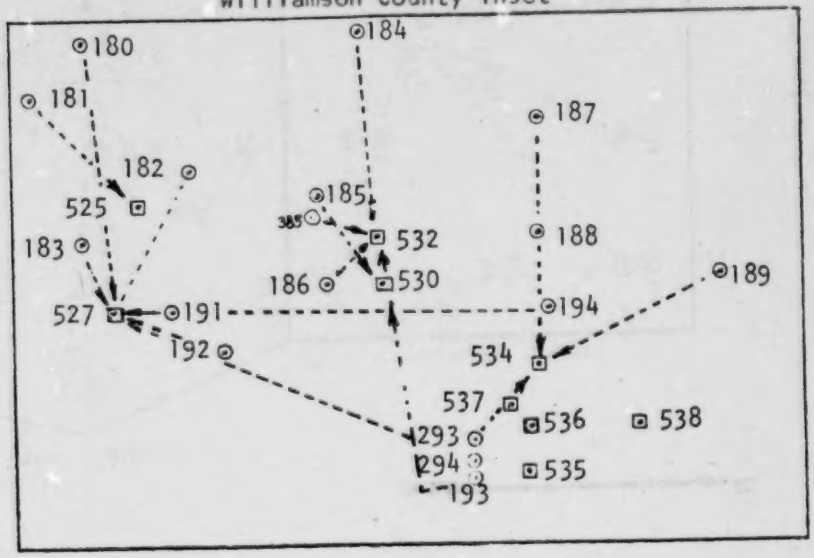
Jackson County Inset



Jefferson County Inset



Williamson County Inset



This summary describes an evaluation of the present system. There are 21 sites under consideration, but 7 of these sites have small operating capacities. These fills are the recipients of all the regions' generated wastes. From the data supplied by the planning commission, source-site pairing and capacities were attained. Some sources are matched with a site by their proximity. The analysis emphasized the following facts:

1. There are number of small sites in the region.
2. There are a number of haul distances which are excessive.
3. The majority of waste is concentrated around 5 or 6 urban areas.
4. All Greater Egypt Regional Waste and only this region's waste is handled within the region in this analysis.

Directions for further analyses:

1. Eliminate the small-high unit cost fill sites.
2. Increase operating capacities of the available large sites.
3. Use transfer station to reduce long distance haul costs.
4. Reduce total haul cost by stopping route cross-over.
5. Consider the use of a centrally located processing facility.

The next logical step (Alternative 2, pp. 19, 20) is to consider using the seven principal, existing landfills and to optimize haul by matching each waste source with the nearest disposal site. It is noted that of these 7 principal landfills, only Sites No. 503, 534, 509, and 524 have permits, or have taken some action to obtain permits. The total system unit cost ($6.75/ton) shows a significant improvement over the existing system. This solution has a political advantage in that no wastes cross county boundaries.

Alternative 3 examines the possibility for further savings by reducing the number of facilities to one landfill in each county. Existing Sites No. 503, 509, and 524 were used for Franklin, Jackson, and Perry counties respectively. New sites (601 and 602) were proposed to replace the two sites each in Jefferson and Williamson counties. As might be expected, the total facilities cost decreased and the haul cost increased. The system unit cost ($6.73/ton), however, is not significantly different from the 7-landfill solution of Alternative 2.

Alternative 4 examines the possibilities of a true, regional system using transfer stations in Mount Vernon, West Frankfort, Energy, and Carbondale. The regional landfill would be located near Pinckneyville in Perry County. The general costs shown on the diagram suggests a slight saving in facility cost (over the 5-landfill system of Alternative 3) and a sharp increase in haul cost. The system unit cost ($9.00/ton) is a significant increase over the existing system ($8.40/ton) and is an indication of costs likely to be incurred by a region that does not generate a sufficient quantity of waste to economically support a system of transfer stations.

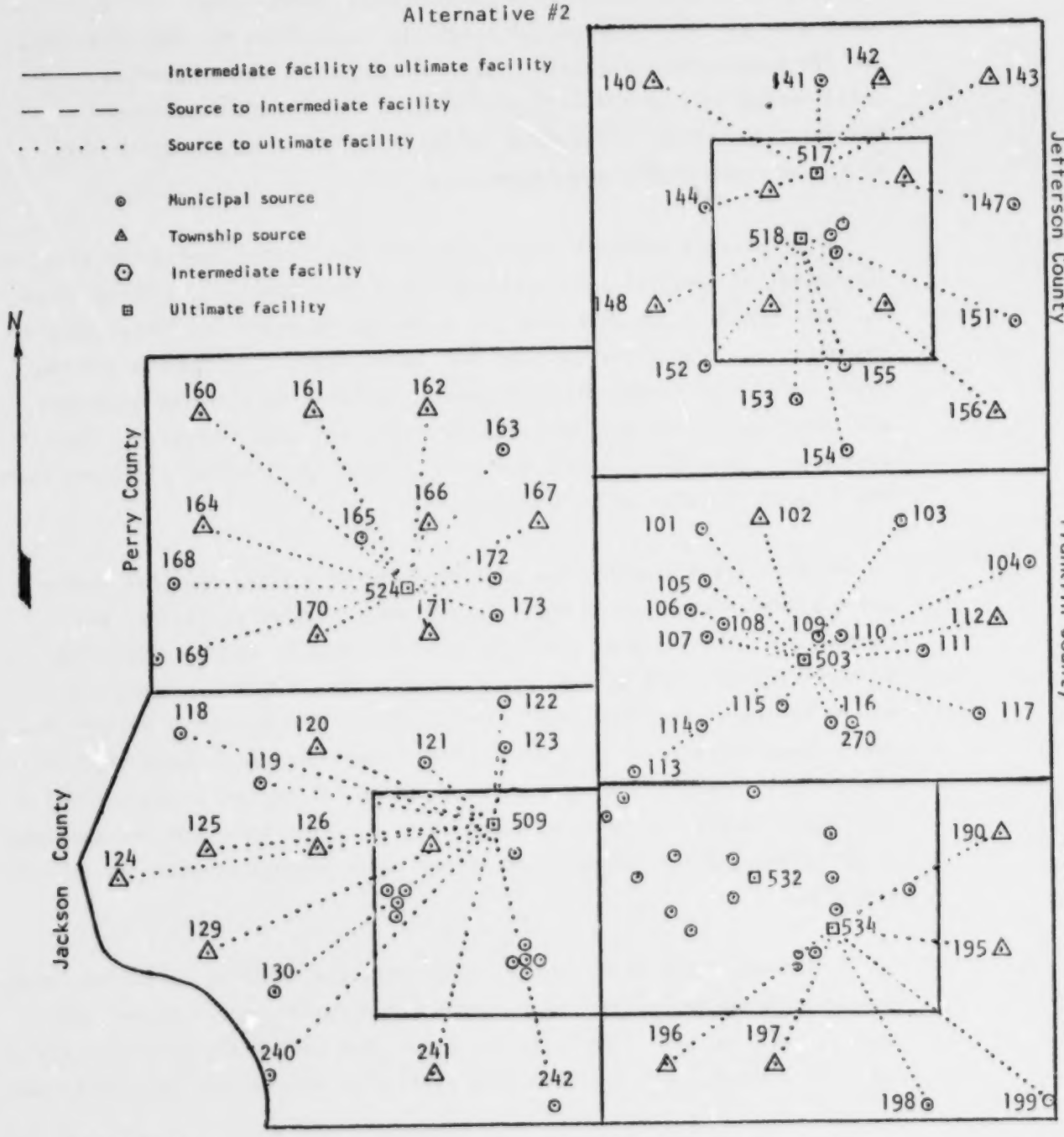
To summarize the short-term alternatives, the existing situation shows the convenience and expense of having too many small landfills and overlapping haul routes. Experience has shown that most small landfills are not only uneconomical, but also have difficulty meeting environmental needs.

Alternatives 2 and 3, by comparison, provide for a larger scale of operation and better management. An indication of this is the fact that only the 3 existing county-wide landfills have IEPA permits (or at least have submitted a permit application). The disadvantage of the

GREATER EGYPT Regional Planning Area

Cost of Existing System As Modified March 1974

Alternative #2



GENERAL COSTS

Total Facility Annual Cost	$636,302
Total System Haul Cost	$908,525
Total System Annual Cost	$1,544,827
Total System Annual Unit Cost	$ 6.75/Ton
Tonnage Handled in System	4401 Ton/Week

GENERAL HAUL COST ASSUMPTIONS

Packer Haul Cost - $4.36/Ton-Hr.

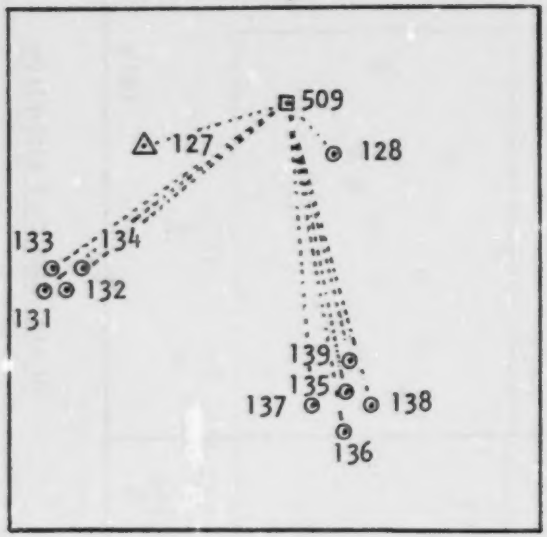
Transfer Haul Cost - $1.40/Ton-Hr.

GREATER EGYPT PLANNING REGION

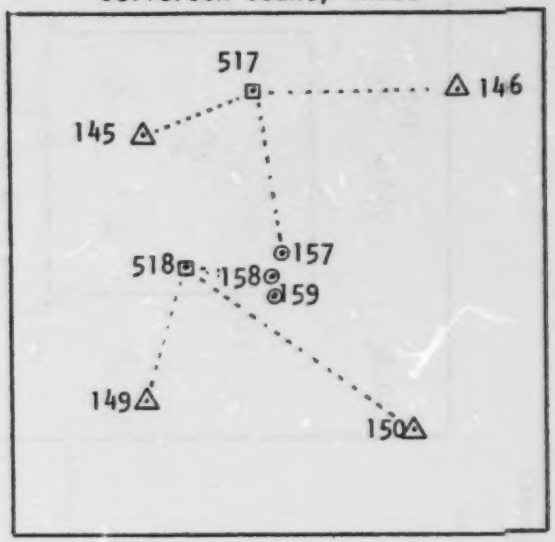
Congested Area Insets

Alternative 2

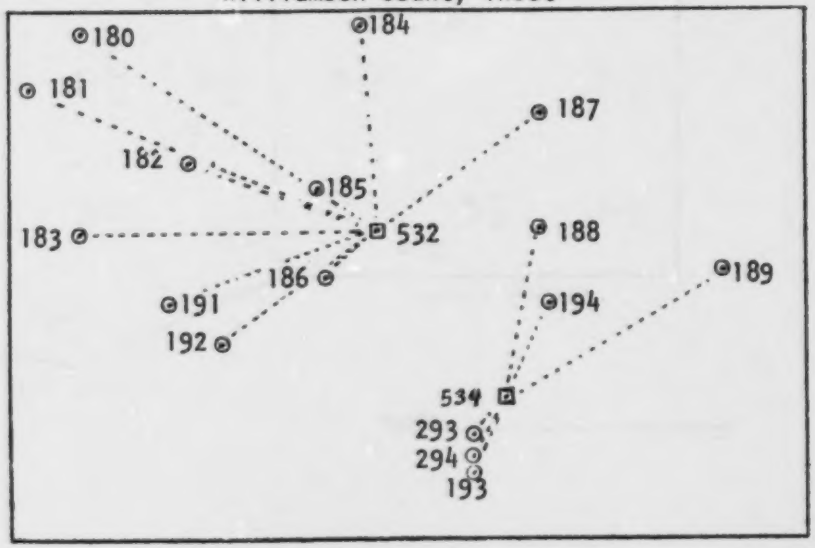
Jackson County Inset



Jefferson County Inset



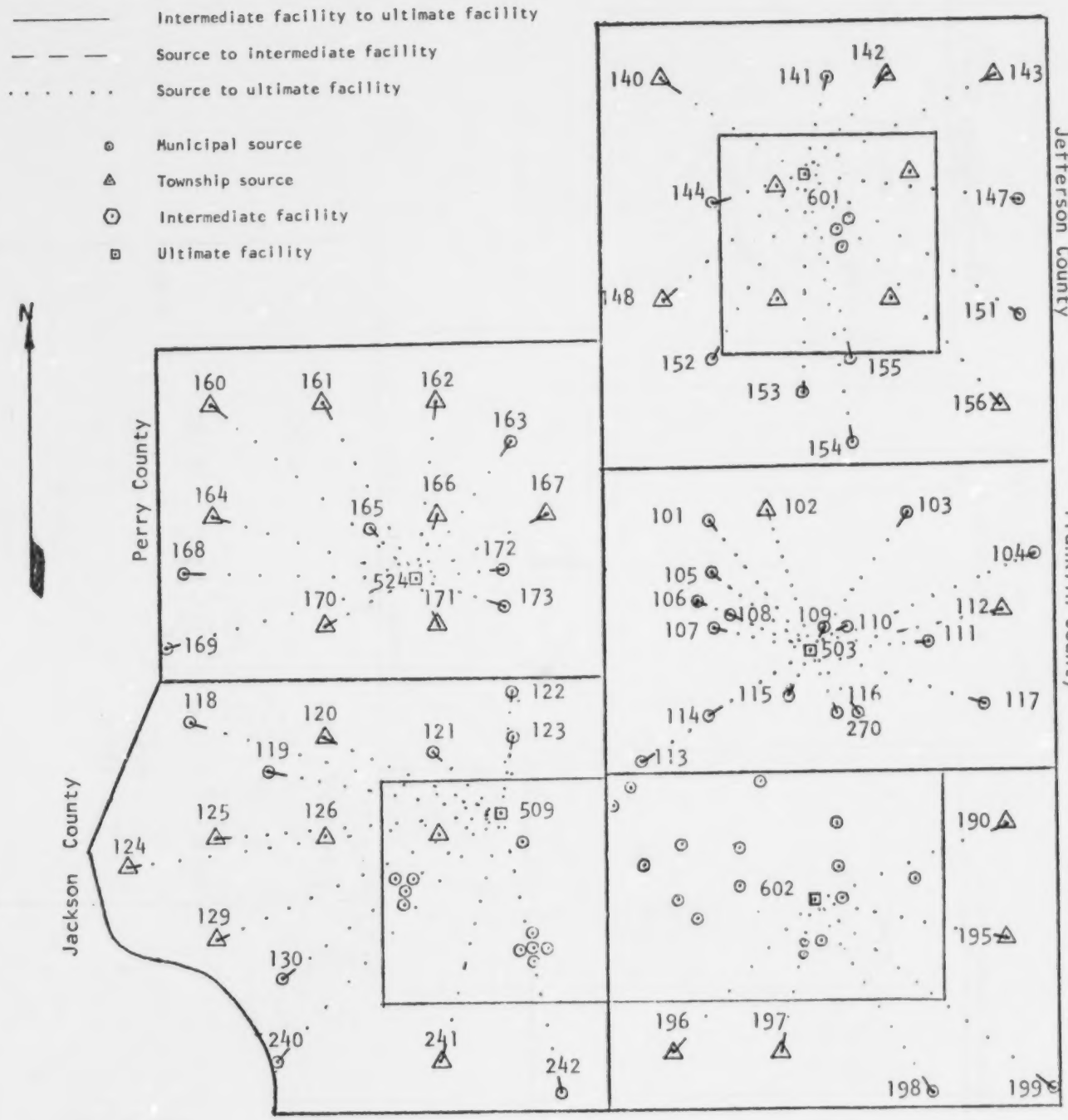
Williamson County Inset



GREATER EGYPT Regional Planning Area

ALTERNATIVE #3

ONE LANDFILL PER COUNTY



GENERAL COSTS

Total Facility Annual Cost	$ 571,979
Total System Haul Cost	$ 968,911
Total System Annual Cost	$1,540,890
Total Facility Unit Cost	$2.48/Ton
Total System Annual Unit Cost	$ 6.73/Ton
Tonnage Handled in System	4403 Ton/Week

GENERAL HAUL COST ASSUMPTIONS

Packer Haul Cost - $4.36/Ton-Hr.

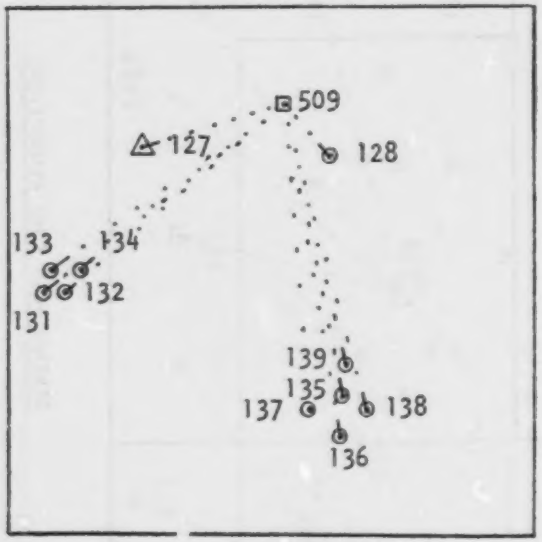
Transfer Haul Cost - $1.40/Ton-Hr.

GREATER EGYPT PLANNING REGION

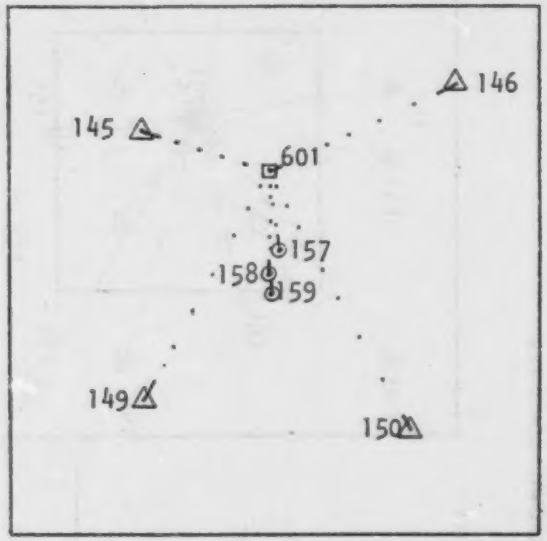
Congested Area Insets

Alternative #3

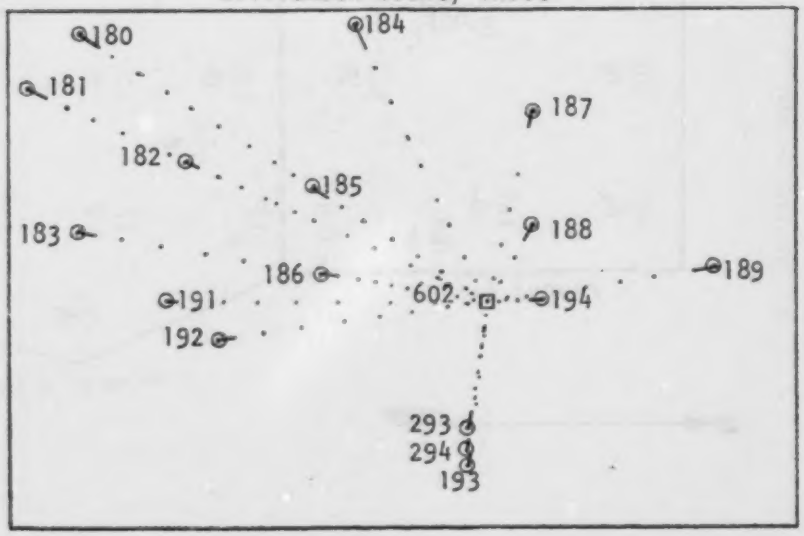
Jackson County Inset



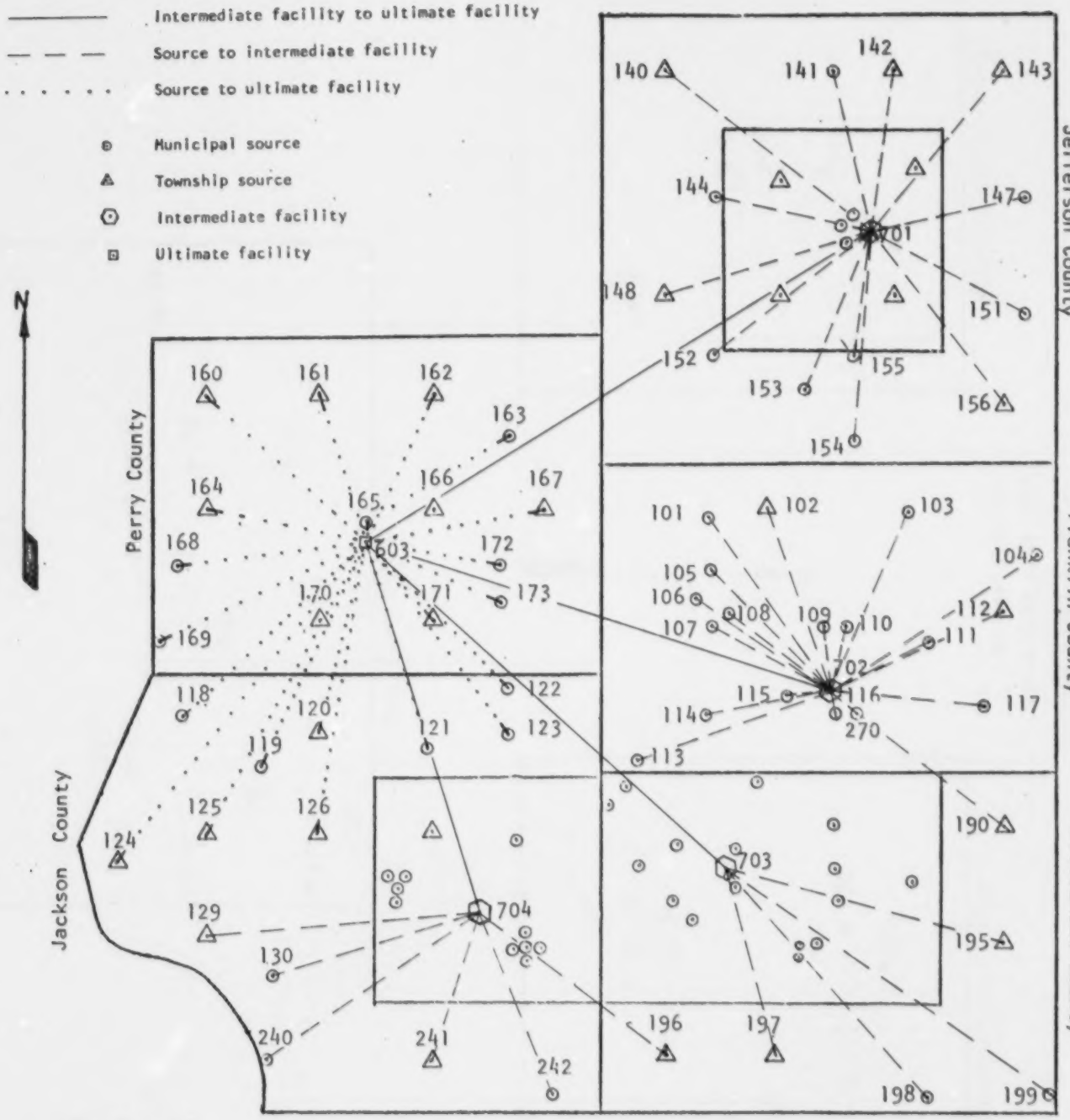
Jefferson County Inset



Williamson County Inset



GREATER EGYPT Regional Planning Area
Alternative #4
TRANSFER STATIONS WITH REGIONAL LANDFILL



GENERAL COSTS

Total Facility Annual Cost	$ 557,584
Total System Haul Cost	$1,502,252
Total System Annual Cost	$2,059,836
Total System Annual Unit Cost	$ 9.00/Ton
Tonnage Handled in System	4401 Ton/Week

GENERAL HAUL COST ASSUMPTIONS

Packer Haul Cost - $4.36/Ton-Hr.

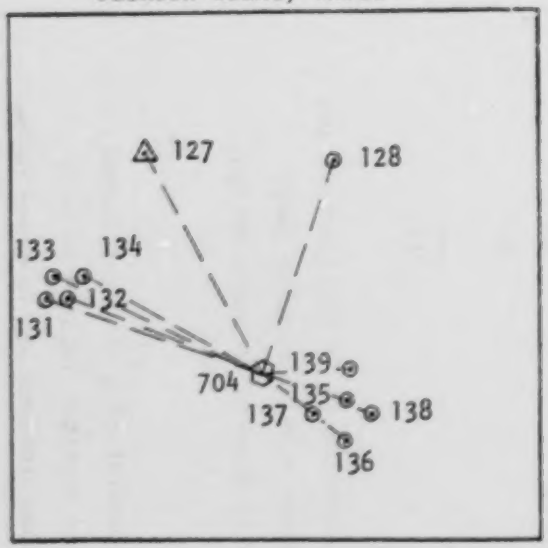
Transfer Haul Cost - $1.40/Ton-Hr.

GREATER EGYPT PLANNING REGION

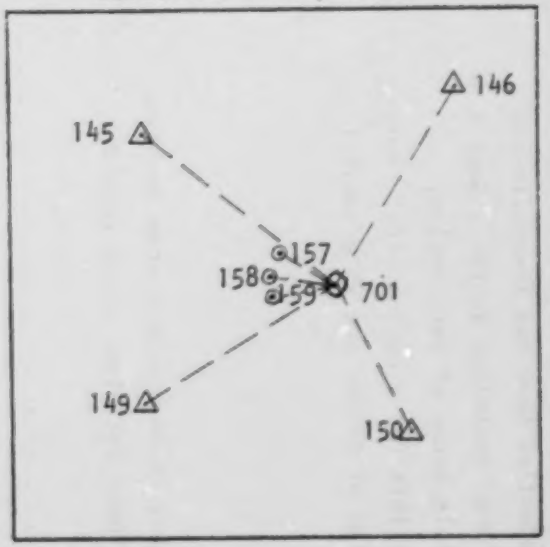
Congested Area Insets

Alternative #4

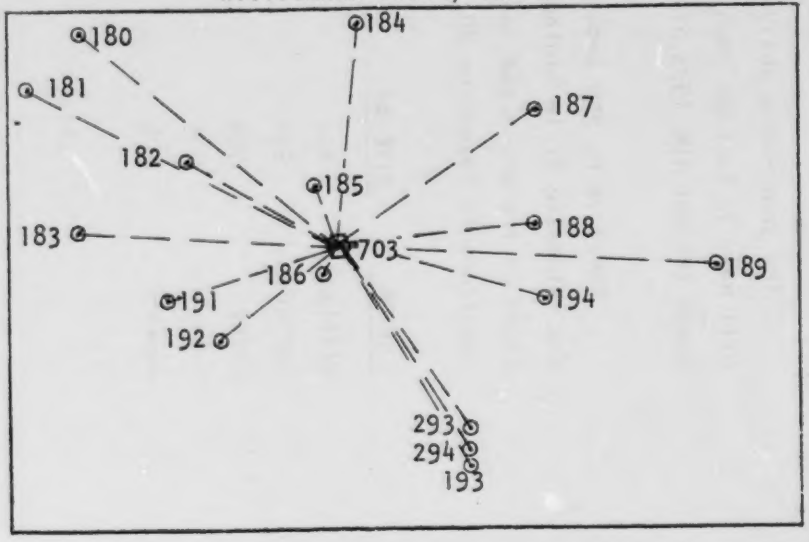
Jackson County Inset



Jefferson County Inset



Williamson County Inset



single-landfill-per county concept is that persons living in areas remote from the landfill will be tempted to find less costly solutions - possibly some form of open dumping. Several counties have had found limited success in such areas with a "green box" container system. Such a system might have application in certain areas of this region. Alternative 4 is not economically feasible for a region with: suitable landfill sites; limited quantities of waste; and long hauls to disposal sites.

Long-Range Analysis

The short-term analysis showed that in each county some decision will have to be made soon. Ideally, these decisions would consider needs through the 1993 planning period.

There is no shortage of suitable landfill sites because of the extensive strip mining that has taken place in the region. Based on the projected waste tonnage for the 1973-1993 period land requirements (based on 20-foot fill depth) are as follows:

COUNTY	SITE NO.	AVERAGE TONS/YR.	ACRES REQUIRED THROUGH 1993
Williamson	602	64,293	159
Jefferson	601	42,653	106
Perry	524	33,135	82
Franklin	503	66,849	166
Jackson	509	80,868	201
	TOTALS	287,798	714

Another opportunity in long-term planning is to consider systems - such as incineration and resource recovery - which require large capital investment and which require 4 to 5 years to plan, design, finance and construct.

Alternative 5 (no diagram) would consist of a single resource recovery facility supplied from transfer stations located in each of the 4 other counties. The general cost information is given below:

Total System Haul Cost	$1,502,300
Total Resource Recovery System Cost (see Table B-10)	1,340,000
Total Landfill cost (for residue)	122,400
Total System Annual Cost	$2,964,700
Total System Unit Cost	$12.95/Ton
Tonnage Handled in System	4401 Ton/Week

Using the theoretical values given in Table 10 it is conceivable that the value of recovered materials might reach the $7-8/input ton level, leaving a net system cost of about $5.50/ton, which compares favorably with the $6.73/ton cost of Alternative 3.

The potential for recovered materials is quite variable and must be evaluated locally based on the lowest guaranteed return. Present market values may not be sufficient to sustain or approach operating on the level indicated.

A low-risk alternative for resource recovery might be the separate collection of newsprint and corrugated boxes. One national study estimates the contribution of newsprint and corrugated boxes as 6.6% and 8.7% respectively of the total solid wastes generated.

The Greater Egypt Region is now handling 228,800 tons of solid waste per year, of which about 15% is newsprint and corrugated boxes which may be salable at an estimated $20/ton. This could amount to $686,400/year. As an additional benefit, the estimated saving in landfilling cost could be approximately $3/ton, or $102,960. Of course, the cost of separation, storage and delivery to an appropriate buyer must be included as an additional cost of operation.

A resource recovery system such as this can be difficult to organize, but has the potential for reducing the total waste stream by as much as 15%. The revenue derived may be sufficient to make it financially attractive. Here again, regional management is needed to provide the required waste quantities, to obtain good market prices, and to organize efficient operations.

Summary: There is sufficient land in the region for adequate disposal sites. The real question is: how many sites should there be? The least cost alternative had one landfill in each county. Another likely solution involved seven landfills. The economies of scale normally associated with single, regional landfills were quickly absorbed by the high cost of hauling between rural communities and remote landfills.

Use of This Study

The use of the information derived from these analyses is complicated by certain realities. First, is the probability that citizens are not paying the haul and disposal costs identified in the existing system. This study assumes a 5-year amortization schedule for trucks and landfill equipment and union wages for drivers and operators. If actual local costs are known, the costs given here can be adjusted by the regional planner. It is important, however, to recognize that the important consideration is the difference in cost between alternatives. With local costs substituted, this difference will probably be the same.

A second practical consideration lies in the fact that many citizens, perhaps as many as 25% of the population, have no solid waste collection, haul, and disposal service. They will not be easily convinced of the need for a better-managed system. They must be shown that, directly or indirectly, they are paying the price for solid waste management.

One approach to this problem is to evaluate the hidden and indirect costs of inadequate solid waste management practices. The convenience and the saving in time and transportation costs for self-hauling to traditional disposal site are obvious and will become more evident when many of the small landfills close in response to State environmental regulations.

A more pertinent argument can be made from the fact that it is the rural landowner who generally pays for an inadequate solid waste management system because of the promiscuous dumping on his land or along the roads which serve his property. The aggravation, the possible land devaluation, and

the legal liabilities of having an open dump on his property are real costs to the landowner. The road maintenance funds spent on trash pick-up have been estimated by one study at $50 per ton. This diversion of road funds can only result in less road maintenance and an inconvenience to the rural landowners. In either case, part of the rural property-tax dollar will be used for the disposal of solid waste.

This study is intended for the regional planning officials whose job is to work with local elected officials to find ways to meet local needs. The alternatives show the comparative economics of several management systems. The elected officials must find ways to show the public that the most equitable system is one in which everyone participates. Should public officials and planner desire to modify or update these alternatives, the Illinois Institute for Environmental Quality will provide assistance.

APPENDIX A

GREATER EGYPT REGIONAL INFORMATION

		Page
1.	Geological Information	A-1
2.	Population Projections - Table A-1	A-6
3.	Employment Projections - Table A-3	A-11
4.	Total Solid Waste Quantities - Table A-3	A-20
5.	Crisis and Decision Dates for Greater Egypt Region - Table A-4	A-23

Geological Information

FRANKLIN

Type of Bedrock:	Mainly shale with some permeable sandstone and limestone.
Drift Thickness:	Less than 50 ft. of drift in most locations with some areas of exposed bedrocks.
Type of Drift Mtl:	Lake deposits and till.
Glacial Aquifers:	Absent.
S & G Aquifers:	Along Big Muddy - scattered, remaining area - rare.
Limestone Aquifers:	Absent.
Sandstone Aquifers:	Possibly present.

The bedrock in Franklin County is composed of mainly non-permeable shale with some permeable sandstone. The bedrock valleys correspond to present day valleys. Glacial drift is from 50 to 200 ft. deep only in the south central area, but the remainder of the area has less than 50 ft. of drift with some areas of exposed bedrock. The drift material is mainly outwash and alluvium with till in some locations. Loess covers the drift in a 4 ft. layer. Sand and gravel aquifers are scattered along the Big Muddy River Valley, but are rare elsewhere. Limestone aquifers do not appear, but sandstone aquifer are prevalent.

The combined bedrock and the unconsolidated aquifer potentials encompass the entire county with a moderate danger level. The drift is minimal, not providing sufficient protection for either type aquifer.

Geological Information

JACKSON

Type of Bedrock:	Majority of the area mainly shale with sandstone and limestone, along Mississippi River - fractured limestone and sandstone.
Drift Thickness:	South portion driftless, 50 - 200 ft. in North east corner, less than 50 ft. for remaining area.
Type of Drift Mtl:	Lake deposits, outwash and alluvium, till.
Glacial Aquifers:	Absent
S & G Aquifers:	Extensive-along Mississippi, scattered-along Big Muddy, rare-in the remainder.
Limestone Aquifers:	Absent
Sandstone Aquifers:	Possibly Present.

Mainly shale with some water yielding sandstone and limestone and only limestone and sandstone in other areas are the major constituents of the bedrock. The bedrock valleys coincide with the major river valley. The driftless portion of the county has outwash and alluvium and till material. In the northeast corner of the county there is an area of 50 to 200 ft. of drift material whereas the remainder of the county has less than 50 ft. with some areas of exposed bedrock. The drift materials within the glacial plain are lake deposits and till with 4 to 8 ft. of loess. Sand and gravel aquifers are extensive along Mississippi River, scattered along Big Muddy, but rare otherwise. Sandstone, but no limestone aquifers are located in the area.

Potential bedrock contamination is moderate in the thin drift areas, but the potential for unconsolidated aquifer contamination is high in the lake deposit and outwash-alluvium areas. This is due to the high permeability of this material. Looking at the two types of contamination overlaid, leaves very little of the area as having a sufficient amount of water resource protection.

Geological Information

JEFFERSON

Type of Bedrock:	Mainly shale with some water-yielding sandstone and limestone.
Drift Thickness:	50 ft. or less with exposed areas of bedrock.
Type of Drift Mtl:	Lake deposits - along Big Muddy River, Till - mainly.
Glacial Aquifers:	Absent
S & G Aquifers	Scattered-along Big Muddy River, Rare - for the remainder of the area.
Limestone Aquifers:	Absent
Sandstone Aquifers:	Possibly Present

The entire county has bedrock of non-permeable shale with some permeable sandstone and limestone. The river valleys do coincide with the bedrock valleys in most cases. The drift is consistently less than 50 ft. with the possibility of exposed bedrock. The drift material is mainly till with lake deposits in the river valley. The sand and gravel aquifers are scattered exclusively along the Big Muddy River. No limestone, but sandstone aquifers are prevalent in the area.

Along the river valley, the potential level of contamination of the unconsolidated layers is moderate as this is the only area of sand and gravel aquifers. Due to the drift thickness in the remainder of the county, the potential for bedrock contamination is also moderate throughout site selection.

Geological Information

PERRY

Type of Bedrock:	Shale with some sandstone and limestone
Drift Thickness:	Less than 50 ft. deep
Type of Drift Mtl:	Lake deposits and till
Glacial Aquifers:	Absent
S & G Aquifers:	Scattered along the surface waters
Limestone Aquifers:	Absent
Sandstone Aquifers:	Possibly present

Mainly shale, some water-yielding sandstone and limestone are the components of the bedrock. The bedrock is overlain by a layer of glacial drift less than 50 ft. deep, which is composed of lake deposits along the Beaucoup Creek and the Little Muddy River, and till in the remainder of the area. Scattered sand and gravel aquifer are located along the surface waters, but are found rarely otherwise. No limestone, but sandstone aquifers are found throughout the area.

A moderate potential for the contamination of the bedrock aquifers exists in the western half and along the eastern border. The remainder of the county has a moderate potential for the contamination of the unconsolidated layer aquifers. The depth of the drift and the type of drift do not appear to be conducive to landfilling operations as the drift provides little protection.

Geological Information

WILLIAMSON

Type of Bedrock:	Mainly shale with some water-yielding sandstone and limestone
Drift Thickness:	Less than 50 ft.
Type of Drift Mtl.	Lake deposits
Glacial Aquifers:	Absent
S & G Aquifers:	Scattered - along Big Muddy River and Crab Orchard Creek, rare-otherwise
Limestone Aquifers:	Absent
Sandstone Aquifers:	Possibly present

Shale and some permeable sandstone and fractured limestone are the major constituents of the bedrock. The majority of the drift is less than 50 ft. deep with the northwest corner of the county, having a slightly thicker depth of drift. The drift materials are lake deposits and till. Sand and gravel aquifer are found scattered only along Big Muddy River and Crab Orchard Creek. Sandstone, but no limestone aquifers are found in the area.

The bedrock potential contamination level is moderate across the northern half and along the southern border, as these locations have thin drift.

The potential for sand and gravel aquifer contamination is high wherever this type of aquifer may be found. The potential is moderate to high for the entire county.

Table A-1-1

GREATER EGYPT REGION

PROJECTED POPULATION FOR

FRANKLIN COUNTY

Location	1970*	1975	1980	1985	1990	1995	2000
Incorporated							
Benton	6833	7340	7390	7710	7980	8360	8640
Buckner	489	470	440	410	390	370	350
Christopher	2910	2860	2780	2800	2800	2830	2820
Ewing	220	220	200	200	190	190	190
Hanaford	289	260	250	240	240	230	230
North City	356	320	300	290	280	270	260
Orient	502	470	430	410	390	370	350
Royalton	1166	1120	1070	1060	1030	1020	1000
Sesser	2125	2110	2150	2260	2360	2500	2600
Thompsonville	449	440	430	430	440	440	450
Urbain	49	40	36	33	31	28	26
Valier	628	600	580	570	560	560	550
West City	637	670	630	610	590	580	560
West Frankfort	8836	8690	8360	8340	8240	260	8160
Zeigler	1940	1900	1810	1780	1740	1720	1680
Freemanspur	171	170	160	150	150	150	140
Macedonia	24	25	23	22	22	21	20
Sub Total	27624	27700	27100	27300	27400	27900	28100
Unincorporated	10705	10100	9660	9480	9250	9140	8920
County Total**	38329	37900	36700	36800	36700	37100	37000

* Census Data Report PC(V1)-15 January 1971

** Summations Performed Prior to Rounding Off

Table A-1-2

GREATER EGYPT REGION

PROJECTED POPULATION FOR

JACKSON COUNTY

Location	1970*	1975	1980	1985	1990	1995	2000
Incorporated							
Ava	728	710	750	750	770	780	790
Campbell Hill	300	270	280	270	260	260	250
Carbondale	22816	25100	29900	33300	37600	42000	46900
DeSoto	966	1010	1150	1240	1350	1470	1600
Dowell	423	390	390	360	340	320	310
Elkville	850	820	860	860	870	880	890
Gorham	361	330	330	310	300	280	270
Grand Tower	664	680	690	650	630	610	590
Makanda	176	160	160	150	150	140	140
Murphysboro	10013	10400	11400	11700	12400	13100	13800
Vergennes	323	330	350	360	370	390	400
Sub Total	37620	40300	46300	50000	55100	60300	66100
Unincorporated	17388	17900	19900	21000	22500	24000	25800
County Total**	55008	58200	66300	71000	77700	84400	91900

* Census Data Report PC(V1) 15 January 1971

** Summations Performed Prior to Rounding Off

Table A-1-3

GREATER EGYPT REGION

PROJECTED POPULATION FOR

JEFFERSON COUNTY

Location	1970*	1975	1980	1985	1990	1995	2000
Incorporated							
Belle Rive	279	270	260	260	270	280	280
Bluford	465	420	420	430	450	470	480
Bonnie	314	310	330	360	400	440	480
Dix	167	150	150	150	150	150	150
Ina	333	290	270	260	250	240	230
Mount Vernon	16382	16500	16800	17600	19000	20100	21000
Nason	186	160	150	150	150	140	140
Waltonville	381	370	360	360	370	380	380
Woodlawn	308	270	270	270	290	300	300
Sub Total	18815	18700	19100	19900	21400	22600	23500
Unincorporated	13033	12500	11900	11700	11800	11700	11400
County Total**	31848	31300	31100	31700	33200	34300	34900

* Census Data Report PC(V1)-15 January 1971

** Summations Performed Prior to Rounding Off

Table A-1-4

GREATER EGYPT REGION

PROJECTED POPLULATION FOR

PERRY COUNTY

Location	1970*	1975	1980	1985	1990	1995	2000
Incorporated							
Cutler	508	620	600	590	600	610	610
Duquoin	6691	8730	8560	8540	8700	8860	9000
Pinckneyvil Prec.	3377	4540	4580	4710	4940	5170	5410
St. Johns	220	260	240	230	220	220	210
Tamaroa	799	960	930	920	920	920	920
Willisville	659	760	740	730	730	740	740
Sub Total	12254	15800	15600	15700	16100	16500	16900
Unincorporated	7503	9370	8920	8640	8540	8440	8320
County Total**	19757	25200	24600	24300	24600	24900	25200

* Census Data Report PC(VI)-15 January 1971

** Summations Performed Prior to Rounding Off

Table A-1-5

GREATER EGYPT REGION

PROJECTED POPULATION FOR

WILLIAMSON COUNTY

Location	1970*	1975	1980	1985	1990	1995	2000
Incorporated							
Bush	357	360	340	330	320	310	290
Cambria	798	790	830	890	950	1020	1080
Carterville	3061	3170	3300	3510	3720	3950	4130
Colp	271	240	240	240	240	250	250
Crainville	549	590	630	700	770	840	910
Creal Springs	830	840	840	870	890	920	930
Energy	812	850	940	1050	1180	1310	1430
Herrin	9623	10500	10800	11500	12200	12900	13400
Hurst	934	950	960	1010	1050	1090	1120
Johnston City	3928	3830	3740	3740	3720	3710	3640
Marion	11724	13400	14300	15600	16900	18400	19600
Pittsburg	509	460	440	420	410	400	380
Spillertwon	305	300	320	360	400	440	480
Whiteash	181	180	180	180	180	190	190
Freemanspur	192	190	190	190	190	190	190
Stonefort	178	170	170	170	160	160	160
Sub Total	34252	36900	38300	40900	43400	46100	48300
Unincorporated	14769	14600	14500	14700	15000	15200	15200
County Total**	49021	51500	52800	55700	58400	61400	63600

* Census Data Report PC(VI)-15 January 1971

** Summations Performed Prior to Rounding Off

Table A-2-1

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION
FOR SIC CODES FOUND IN APPENDIX B

FRANKLIN COUNTY

SIC	1971	1975	1980	1985	1990	1995	2000
201	49	51	44	38	33	28	24
205	7	8	8	8	8	8	8
233	174	190	220	260	300	330	370
239	249	250	250	250	260	260	260
2421	31	40	40	40	40	39	39
243*	40	40	40	40	40	39	39
271	74	82	94	100	110	120	140
273	2	3	3	3	3	3	3
275	2	3	3	3	3	3	3
299	56	76	110	150	200	240	280
3272	15	28	44	60	77	93	110
327*	65	79	91	100	110	120	140
328	11	9	5	3	2	1	0
344	65	74	100	140	170	210	250
346	16	20	23	27	31	34	38
353	102	110	120	130	150	160	170
359	6	6	5	5	4	4	3
362	34	49	66	83	100	110	130
3732	399	400	410	410	410	420	420
394	1	2	2	2	2	2	2
399	1	2	2	2	2	2	2

BENTON

SIC	1971	1975	1980	1985	1990	1995	2000
201	66	50	44	38	33	28	24
205	8	8	8	8	8	8	8
239	250	240	240	250	250	250	260
243*	40	39	39	40	40	38	39
271	24	23	23	21	21	20	21
275	3	3	3	3	3	3	3
299	7	7	7	7	8	8	8
3272	13	24	38	52	67	82	97
328	12	8	5	3	1	0	0
344	3	2	2	2	2	2	2
399	2	2	2	2	2	2	2

CHRISTOPHER

SIC	1971	1975	1980	1985	1990	1995	2000
271	16	22	34	42	51	59	73
3272	3	4	5	7	9	11	12
346	12	15	18	21	25	29	32
353	90	94	100	100	120	130	130

Table A-2-1 (cont.)

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION (Continued)
FOR SIC CODES FOUND IN APPENDIX B

ROYALTON

SIC	1971	1975	1980	1985	1990	1995	2000
344	50	59	86	120	150	190	230

SESSER

SIC	1971	1975	1980	1985	1990	1995	2000
233	75	72	88	100	120	140	160
271	17	21	26	29	32	36	42
273	3	3	3	3	3	3	3
327*	14	14	14	14	13	13	14

VALIER

SIC	1971	1975	1980	1985	1990	1995	2000
299	50	68	100	140	190	230	270
394	2	2	2	2	2	2	2

WEST FRANKFORT

SIC	1971	1975	1980	1985	1990	1995	2000
2421	32	40	39	40	40	38	39
271	18	12	9	6	4	3	2
327*	52	64	76	86	95	100	120
344	13	11	10	11	10	11	11
346	5	5	5	5	5	5	5
359	7	6	5	4	4	3	3
362	35	48	65	82	100	110	130
3732	400	400	410	410	410	420	420

ZEIGLER

SIC	1971	1975	1980	1985	1990	1995	2000
233	100	110	130	150	170	180	200
243*	1	0	0	0	0	0	0
353	13	15	18	20	25	28	30

Table A-2-2

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION
FOR SIC CODES FOUND IN APPENDIX B

JACKSON COUNTY

SIC	1971	1975	1980	1985	1990	1995	2000
201	7	10	12	13	14	15	15
2022	118	110	91	74	59	47	37
203	99	87	100	110	110	120	120
205	3	3	2	1	0	0	0
209	9	9	9	9	8	7	7
231	224	240	260	270	280	280	280
238	84	120	150	180	200	220	230
243*	24	50	65	77	87	94	100
244	2	2	2	2	2	2	2
259	19	13	8	5	3	2	1
264	649	480	340	240	170	120	83
271	72	72	69	65	61	57	52
273	1	1	1	1	1	1	1
275	3	5	5	5	5	4	4
286	84	96	100	100	110	110	110
287	24	24	23	22	21	19	18
314	449	430	410	390	360	330	300
3272	3	12	21	29	36	41	46
327*	49	69	62	64	64	64	63
335	199	320	330	340	340	340	330
344	13	11	7	4	3	2	1
358	3	1	0	0	0	0	0
395	2	2	2	2	2	2	2
399	4	10	12	14	16	17	17

AVA

SIC	1971	1975	1980	1985	1990	1995	2000
395	3	2	2	2	2	2	2

CARBONDALE

SIC	1971	1975	1980	1985	1990	1995	2000
2022	119	100	91	74	59	47	37
203	40	30	38	36	31	30	27
264	400	240	130	72	37	18	8
271	73	72	68	64	60	57	52
286	85	95	100	100	100	100	100
3272	4	15	21	29	36	41	46
327*	47	54	59	62	62	63	62
344	14	10	7	3	3	2	1
358	4	1	0	0	0	0	0

Table A-2-2 (cont.)

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION (Continued)
FOR SIC CODES FOUND IN APPENDIX B

ELKVILLE

SIC	1971	1975	1980	1985	1990	1995	2000
273	2	1	1	1	1	1	1

GRAND TOWER

SIC	1971	1975	1980	1985	1990	1995	2000
201	4	5	6	6	7	7	7

Murphysboro

SIC	1971	1975	1980	1985	1990	1995	2000
201	4	5	6	6	7	7	7
203	60	47	61	73	78	89	92
205	4	2	1	1	0	0	0
209	10	9	9	9	8	7	7
231	225	230	260	270	280	270	270
238	85	110	140	170	190	210	220
243*	25	50	65	76	86	93	100
244	3	2	2	2	2	2	2
259	20	13	7	4	2	2	1
264	250	230	200	160	130	100	74
275	4	4	5	5	5	3	3
287	25	24	23	22	21	19	18
314	450	430	400	390	360	320	290
327*	3	4	3	2	1	1	0
335	200	310	330	340	340	330	320
399	5	10	12	13	16	17	16

Table A-2-3

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION
FOR SIC CODES FOUND IN APPENDIX B

JEFFERSON COUNTY

SIC	1971	1975	1980	1985	1990	1995	2000
201	49	140	230	310	380	440	500
2021	7	7	6	6	5	5	5
208	10	3	1	0	0	0	0
233	144	130	120	110	100	97	92
241	19	20	20	20	20	20	21
254	2	2	2	2	2	2	1
271	44	46	47	47	48	49	50
275	11	16	18	19	21	22	24
2819	20	19	17	16	14	14	13
285	39	47	53	59	64	70	75
286	3	3	3	3	2	2	2
287	4	5	6	7	8	9	10
301	1800	1800	1800	1800	1800	1800	1800
311	299	190	110	65	39	23	14
327*	25	23	10	4	2	1	0
336	299	230	170	130	110	88	71
344	21	4	0	0	0	0	0
346	4	4	3	3	3	2	2
351	269	520	740	930	1110	1270	1420
354	3	12	19	25	31	36	41
359	30	39	52	63	72	81	90
361	149	180	210	230	250	280	300
364	39	49	57	64	71	77	83
367	24	35	47	58	68	76	85
371	369	490	590	670	740	820	890
399							

BLUFORD

SIC	1971	1975	1980	1985	1990	1995	2000
275	2	2	1	0	0	0	0

DIX

SIC	1971	1975	1980	1985	1990	1995	2000

MOUNT VERNON

SIC	1971	1975	1980	1985	1990	1995	2000
201	50	130	220	300	370	430	490
2021	8	7	6	6	5	5	5
208	11	2	1	0	0	0	0
233	145	130	110	110	99	96	92
241	20	19	19	19	20	20	21
254	3	2	2	2	2	2	1
271	45	45	46	47	47	49	50
275	8	13	16	17	20	21	23

Table A-2-3 (cont.)

MOUNT VERNON (Continued

SIC	1971	1975	1980	1985	1990	1995	2000
2819	21	19	17	16	14	14	13
285	40	47	53	58	63	69	75
286	4	3	3	3	2	2	2
301	1800	1800	1800	1800	1800	1800	1800
311	300	190	100	64	38	23	13
327*	26	23	10	3	1	1	0
336	300	230	170	120	110	88	71
344	22	4	0	0	0	0	0
346	5	4	3	3	2	1	2
351	270	520	740	930	1110	1270	1420
354	4	11	18	24	30	35	40
359	31	38	52	63	71	80	90
361	150	180	210	230	250	280	300
364	40	49	57	64	71	77	83
367	25	35	46	58	68	75	85
371	370	480	590	670	740	820	890
399	40	35	34	34	34	33	34

Table A-2-4
PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION
FOR SIC CODES FOUND IN APPENDIX B

PERRY COUNTY

SIC	1971	1975	1980	1985	1990	1995	2000
201	219	150	110	87	65	49	37
204	14	13	12	11	11	10	9
208	99	160	200	240	270	310	350
209	24	24	23	23	23	23	22
233	499	660	800	950	1090	1230	1370
242*	15	13	5	2	1	0	0
243*	9	9	9	9	9	9	9
271	14	19	24	28	32	37	41
273	47	61	76	90	100	110	130
275	3	3	3	3	3	2	2
3272	4	4	4	4	4	4	4
327*	34	40	51	61	72	82	92
328	1	0	0	0	0	0	0
344	19	40	63	86	100	130	150
348	233	410	640	870	1090	1310	1530
354	2	2	2	2	2	2	2
359	70	98	120	150	170	200	220
365	449	660	900	1150	1390	1630	1870
394	349	480	600	720	840	960	1080

DUQUOIN

SIC	1971	1975	1980	1985	1990	1995	2000
201	300	150	100	87	64	49	37
204	15	12	11	11	11	9	8
208	100	160	200	230	260	300	340
233	300	390	470	560	650	730	810
273	48	61	76	90	100	110	130
275	4	2	3	3	2	1	2
3272	5	4	4	4	4	4	4
344	20	40	63	86	100	130	150
348	230	410	640	870	1090	1310	1530
359	25	35	45	59	70	86	96
394	350	480	600	720	840	960	1070

PINCKNEYVIL PREC

SIC	1971	1975	1980	1985	1990	1995	2000
209	25	24	23	23	23	25	22
233	200	260	320	370	430	490	540
242*	16	12	4	2	0	0	0
243*	10	9	9	9	9	9	9
271	15	18	23	27	32	37	41
327*	35	40	51	60	72	81	92
328	2	0	0	0	0	0	0
359	16	21	26	31	35	40	43
365	450	650	900	1150	1390	1630	1860

SWANWICK PREC

SIC	1971	1975	1980	1985	1990	1995	2000
359	30	40	48	57	64	73	79

Table A-2-5

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION
FOR SIC CODES FOUND IN APPENDIX B

PROJECTED EMPLOYMENT FOR

WILLIAMSON COUNTY

SIC	1971	1975	1980	1985	1990	1995	2000
201	2	1	0	0	0	0	0
208	116	130	150	160	170	160	150
209	1	1	1	2	2	2	2
229	502	660	460	310	210	130	80
233	475	430	410	380	350	290	240
243*	2	0	0	0	0	0	0
249	15	26	40	50	58	59	57
251	2	0	0	0	0	0	0
265	75	94	110	120	130	130	120
271	32	26	19	13	9	6	3
275	13	9	8	6	5	3	2
282	25	0	0	0	0	0	0
295	64	74	100	120	130	130	130
307	2	0	0	0	0	0	0
3272	24	21	17	13	10	7	5
327*	20	31	34	35	35	32	29
344	2	4	6	8	9	9	9
357	195	180	170	150	140	120	100
359	61	59	59	57	54	47	41
361	125	150	180	200	220	210	200
362	350	260	180	120	83	50	30
369	4	5	6	7	7	7	7
371	1605	1480	1420	1300	1200	1000	830
393	25	35	54	68	79	80	78
395	162	170	190	200	210	200	180
399	60	51	68	80	90	89	85
Total	3968	3899	3682	3399	3201	2761	2378

CARTERVILLE

SIC	1971	1975	1980	1985	1990	1995	2000
229	2	2	4	5	5	6	5
271	3	2	2	2	1	1	1
361	100	100	110	110	120	110	100
399	40	0	0	0	0	0	0

ENERGY

SIC	1971	1975	1980	1985	1990	1995	2000
393	25	34	54	67	78	80	78

HERRIN

SIC	1971	1975	1980	1985	1990	1995	2000
201	2	0	0	0	0	0	0
208	36	33	31	28	26	21	17
229	500	650	450	300	200	120	73
233	475	420	410	370	350	290	230
243*	2	0	0	0	0	0	0

Table A-2-5

PROJECTED EMPLOYMENT FOR GREATER EGYPT REGION
FOR SIC CODES FOUND IN APPENDIX B

PROJECTED EMPLOYMENT FOR

HERRIN (Continued)

SIC	1971	1975	1980	1985	1990	1995	2000
251	2	0	0	0	0	0	0
265	75	94	110	110	120	130	120
275	5	2	1	0	0	0	0
282	25	0	0	0	0	0	0
3272	15	10	9	7	6	4	3
327*	9	12	16	18	20	19	18
344	2	2	3	5	5	5	6
357	195	170	170	150	130	120	99
359	2	0	0	0	0	0	0
371	1605	1480	1420	1290	1190	990	820
399	20	51	68	80	91	90	86

JOHNSTON CITY

SIC	1971	1975	1980	1985	1990	1995	2000
275	1	0	0	0	0	0	0
361	25	45	66	81	96	97	96
369	4	4	6	7	6	6	7

MARION

SIC	1971	1975	1980	1985	1990	1995	2000
208	80	96	110	130	140	130	130
209	1	1	0	2	1	2	1
249	15	26	40	49	57	58	56
271	29	23	16	10	7	4	2
275	7	5	6	5	4	2	1
295	64	73	100	120	130	120	120
307	2	0	0	0	0	0	0
3272	9	10	8	5	3	2	1
327*	20	18	17	16	14	12	10
359	59	57	58	56	53	47	41
395	12	0	0	0	0	0	0

ORDILL

SIC	1971	1975	1980	1985	1990	1995	2000
362	350	250	170	120	82	50	29
395	150	160	190	200	210	190	170

Greater Egypt Region

Study Period Inventory

Table A-3-1
Franklin County

Source Name	Source I.D.#	1973 Quantity (Tons/week)	1990 Quantity (Tons/Week)
Sesser	101	51	87.5
Rend Lake T	102	6	8
Ewing	103	11	20
Macedonia	104	11	16.4
Valier	105	17	25.5
North City	106	4	5
Christopher	107	120	127
Buckner	108	6	8
West City	109	19	28
Benton	110	196	444
Havaford	111	4	5
Akin T	112	11	16
Royalton	113	19	27.4
Zeigler	114	44	64.2
Orient	115	18	24.5
West Frankfort 1	116	422	619
West Frankfort 2	270	40	
Thompsonville	117	17	25.6

Table A-3-2
Jackson County

Source Name	Source I.D. #	1973 Quantity (Tons/week)	1990 Quantity (Tons/week)
Campbell Hill	118	21	24
Ava	119	10	16
Sato T	120	12	13.6
Vergennes	121	88	14.6
Dowell	122	6	7.5
Elkville	123	26	37.5
Jones Ridge T	124	12.	13.6
Kinkaid T	125	12.	13.6
Levan T	126	12.	13.6
Summerset T	127	14.	13.6
DeSoto	128	28.	51.
Jacob T	129	12.	12.8
Gorham	130	17.	20.4
Murphysboro N.E.	131	2.	87.3
" N.W.	132	2.	86.1
" S.E.	133	5.	89.7
" S.W.	134	4.	89.3
Carbondale West	135	175.	268.1
" N.E.	136	130.	197.8
" N.W.	137	170.	256.
" S.E.	138	345.	522.
" S.W.	139	20.	28.
Grande T	140	10.	13.6
Grand Towers	240	27.	15.
Mona T	241	12.	13.6
Makanda	242	14.	3.

Greater Egypt Region

Study Period Inventory

Table A-3-3

Jefferson County

Source Name	Source I.D.#	1973 Quantity (Tons/week)	1990 Quantity (Tons/week)
Dix	141	13	23.3
Texico T	142	10	13.1
Farington T	143	10	13.1
Woodlawn	144	10	19.
Shiloh T	145	8	10.2
Mount T	146	5	7.3
Bluford	147	10	37.4
Blissville T	148	10	13.1
McClellan T	149	9	11.7
Dodds T	150	8	16.2
Belle Rive	151	13	27.7
Waltonville	152	14	20.2
Nason	153	12	16
Ina	154	10	26.6
Bonnie Pop	155	4	21.6
Moores T	156	10	13.1
Mt. Vernon 1	157	204	392.3
Mt. Vernon 2	158	103	196.3
Mt. Vernon 3	159	103	196.3

Table A-3-4

Perry County

Source Name	Source I.D.#	1973 Quantity (Tons/week)	1990 Quantity (Tons/wee
Stanwick T	160	8	15.
No. 4-3 T	161	8	13.
No. 4-2 T	162	8	13.
Tamoroa	163	18	18.
Jamestown T	164	7	13.
Pinckneyville	165	98	54.
No. 5-2 T	166	7	13.
No. 1 T	167	8	15.
Cutter	168	14	26.5
Willisville	169	11	24.8
No. 6-3 T	170	7	13.
No. 6-2 T	171	7	13.
St. Johns	172	3	94.
DuQuoin	173	260	485.1

Greater Egypt Region

Study Period Inventory

Table A-3-5

Williamson County

Source Name	Source I.D.#	1973 Quantity (Tons/week)	1990 Quantity (Tons/week)
Bush	180	5.	7
Hurst	181	14.	20.4
Colp	182	5.	6.2
Cambria	183	12.	22.8
Freeman-spur	184	4.	5.4
Herrin	185	355	375.
N.E. Herrin	385	35	37
Energy	186	11	26
Johnston City	187	79	120
Whiteash	188	2	3.
Pittsburg	189	6	8
Corinth T	190	14	20
Carterville	191	67	118
Grainsville	192	7	15
Marion Central	193	25	353
Marion N.E.	293	190	46
Marion S. W.	294	81	150
Spillerton	194	5	9
Bankston T	195	17.	20
Devils Kitchen T	196	15.	20
Federal Prison T	197	15.	21
Creal Spring	198	26.	39
Stonefort	199	17.	24

Table A-4

Decision and Crisis Dates For Greater Egypt Region

The following dates are based on present waste loads and source-site pairings in the original set of data. The crisis date reflected the expected completion of the landfill site. The decision date is assumed to allow for 2 years of lead time. The dates were based on the regional inventory made in 1973.

Landfill Site I.D.	503	506	507	508	509	511	515	516	517
Crisis Date	1977	1974	Now	1975	1989	1974	1976	1976	1980
Decision Date	1975	Now	Now	Now	1979	Now	Now	Now	1978

Landfill Site I.D.	518	520	524	525	527	530	532	534	535
Crisis Date	1982	1975	1977	1974	1981	1983	1978	1990	1975
Decision Date	1980	Now	1975	Now	1979	1981	1976	1978	1977

Landfill Site I.D.	536	538
Crisis Date	1974	1974
Decision Date	Now	Now

Decision and Crisis Dates For Refined Existing System

The decision and crisis dates reflect the completion of an existing site with source-site pairing as seen in alternative 2. The dates are based on information supplied by the regional planning commission in March of 1974. The new information reflected the closing of some of the small high cost landfills.

Landfill Site I.D.	503	509	517	518	524	532	534
Crisis Date	1977	1980	1985	1984	1977	1977	1980
Decision Date	1975	1978	1983	1982	1975	1975	1978

Decision and Crisis Dates For Regionalized System

The following decision and crisis dates for the existing facilities are based on data supplied by the regional planning commission. The new sites (601, 602) are assumed to be designed with a 20 year life. An average of the 1973 and 1993 waste loads was used to determine the completion dates for the landfills of Alternative 3 with the assumption that when any facility is completed it will be replaced with another that can manage the same wasteloads.

Landfill Site I.D.	503	509	601	602	524
Crisis Date	1976	1978	1993	1993	1976
Decision Date	Now	1976	1991	1991	Now

APPENDIX B

	Pages
1. Method for calculating municipal and industrial collection rates.	B-1
2. Industrial waste generation factors. Table B-1	B-3
3. Haul Cost Factor with assumptions. Table B-2	B-6
4. Cost Functions: Sanitary Landfill. Figure B-1	B-9
5. Basic Landfill Cost Assumptions For 50, 100, 250, 500, 1000, 2000, and 5000 tons/week. Tables B-3 to B-9	B-10
6. Cost Functions: Intermediate Processing Facilities. Figure B-2	B-18
7. Equations for Facility Cost Functions.	B-19
8. Resource Recovery Facility Description.	B-21
9. Resource Recovery Capital and Annual Cost. Table B-10	B-22

Municipal Generation Rates

The technique selected for estimating present generation rates was developed by Roy F. Weston, Inc. The technique involved the calculation of a generation rate factor which was then multiplied by the population to obtain the generation rate per week for a given geographic area. The generation factor is a function of the population density as shown in the following equations:

$$U = 1.54 \text{ Log } D - 0.68$$

$$V = U \times 7 \text{ day/week} \times 1 \text{ ton/2000 lbs.}$$

$$W = V \times \text{Population within the given area}$$

where: U = per capita waste generation rate in lbs/capita /day

D = population density in person/square miles

V = per capita waste generation rate in tons/capita/week

W = ton per week of waste generated within given area

This relationship is valid in the population density range of 500 - 12,000 persons/square mile. Below the lower limit of the range, the generation factor used is 3.4 lbs/capita/day; above the upper limit, the factor used is 5.6 lbs/capita/day.

Industrial Generation Rate

During the past few years, the Office of Solid Waste Management Programs has funded a number of industrial solid waste surveys to develop solid waste generation factors. A summary of these factors was used to develop industrial solid waste loads by SIC number. The following equation demonstrates the use of the generation factors.

$$I = G.F. \times \text{No. of Employees}$$

$$J = I \div 52$$

where I = yearly production rate in tons/year

G. F = generation factor in tons/employee/year

J = weekly production rate in tons/week

These relationships are used to estimate probable industrial waste loads, but the yearly employment fluctuation, and generation factors make adjustment necessary for specific locations and plants.

TABLE B-1

Industrial Solid Waste Generation Factors [8]

SIC No.	Name	Generation Factor (tons/employee/year)
201	Meat Products	14.1
2021	Creamery butter	33.0
2022	Cheese, Natural and Processed	169.1
202 (R)[1]	Dairy Products	2.2
203	Canned and Preserved Fruits, Vegetables and Sea Foods	5.4
204	Grain Mill Products	6.2
205	Bakery Products	1.2
206	Sugar	17.2
207	Confectionery and Related Products	3.3
208	Beverages	11.0
209	Miscellaneous Food Preparations and Kindred Products	0.8
211	Cigarettes	1.5
212	Cigars	3.1
213	Tobacco (Chewing and Smoking) and Snuff	0.2
214	Tobacco Stemming and Redrying	4.4
221	Broad Woven Fabric Mills, Cotton	0.4
222	Broad Woven Fabric Mills, Man-made Fiber and Silk	0.7
223	Broad Woven Fabric Mills	0.1
224	Narrow Fabrics and Other Small-wares Mills: Cotton, Wool, Silk and Man-made Fiber	1.2
225	Knitting Mills	1.3
226	Dyeing and Finishing Textiles, Except Wood Fabrics and Knit Goods	2.4
227	Floor Covering Mills	0.2
228	Yarn and Thread Mills	0.7
229	Miscellaneous Textile Goods	4.5
231	Men's, Youths', and Boys' Suits, Coats and Overcoats	0.3
232	Men's, Youths', and Boys' Furnishings, Work Clothing, and Allied Garments	0.3
233	Women's, Misses', and Juniors' Outerwear	0.9
234	Women's, Misses', Children's and Infants' Under Garments	0.4
235	Hats, Caps, and Millinery	0.2
236	Girls', Children's, and Infants' Outerwear	0.9
237	Fur Goods	0.5
238	Miscellaneous Apparel and Accessories	0.4
239	Miscellaneous-Fabricated Textile Products	0.4
241	Logging Camps and Logging Contractors	30.0
2421	Sawmills and planing mills, general	420.0
242 (R)[1]	Sawmills and planing mills	38.7
2432	Veneer and plywood	232.0
243 (R)[1]	Millwork, Veneer, Plywood, and Prefabricated Structural Wood Products	21.7
244	Wooden Containers	16.0
249	Miscellaneous Wood Products	43.0
251	Household Furniture	1.8
252	Office Furniture	2.6
253	Public Building and Related Furniture	1.8
254	Partitions, Shelving, Lockers, and Office and Store Fixtures	3.6
259	Miscellaneous Furniture and Fixtures	1.5
261	Pulp Mills	31.5
262	Paper Mills, Except Building Paper Mills	11.7
263	Paperboard Mills	11.5
264	Converted Paper and Paperboard Products, Except Containers and Boxes	4.0
265	Paperboard Containers and Boxes	12.6
266	Building Paper and Building Board Mills	103.0
271	Newspapers: Publishing, Publishing and Printing	1.1
272	Periodicals: Publishing, Publishing and Printing	0.1
273	Books	0.8
274	Miscellaneous Publishing	0.1
275	Commercial Printing	1.1
276	Manifold Business Forms	4.4
277	Greeting Card Publishing	1.2
278	Blankbooks, Loose Leaf Binders, and Bookbinding and Related Work	2.6
279	Service Industries for Printing Trade	1.4
2819	Industrial Inorganic Chemicals, not Elsewhere Classified	109.0
281 (R)[1]	Industrial Inorganic and Organic Chemicals	18.8
282	Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Man-Made Fibers, Except Glass	16.2

TABLE B-1

Industrial Waste Generation Factors (Continued)

SIC No.	Name	Generation Factor (tons/employee/year)
283	Drugs	3.4
284	Soap, Detergents, and Cleaning Preparations, Perfumes, Cosmetics, and Other Toilet Preparations	3.3
285	Paints, Varnishes, Lacquers, Enamels, and Allied Products	6.2
286	Gum and Wood Chemicals	0.1
287	Agricultural Chemicals	13.5
2891	Adhesives and gelatin	39.4
289 (R)[1]	Miscellaneous Chemical Products	1.2
291	Petroleum Refining	30.6
295	Paving and Roofing Materials	0.9
299	Miscellaneous Products of Petroleum and Coal	9.3
301	Tires and Inner Tubes	3.7
302	Rubber Footwear	2.1
303	Reclaimed Rubber	2.4
306	Fabricated Rubber Products, Not Classified Elsewhere	2.5
307	Miscellaneous Plastics Products	1.3
311	Leather Tanning and Finishing	2.3
312	Industrial Leather Belting and Packing	0.8
313	Boot and Shoe Cut Stock and Findings	1.8
314	Footwear, Except Rubber	0.4
315	Leather Gloves and Mittens	1.3
316	Luggage	7.0
317	Handbags and Other Personal Leather Goods	0.4
319	Leather Goods, Not Elsewhere Classified	0.5
321	Flat Glass	2.5
322	Glass and Glassware, Pressed or Blown	1.4
323	Glass Products, Made of Purchased Glass	1.8
324	Cement, Hydraulic	8.8
325	Structural Clay Products	1.7
326	Pottery and Related Products	3.6
3272	Concrete products, except block and brick	154.0
327 (R)[1]	Concrete, Gypsum, and Plaster Products	15.0
328	Cut Stone and Stone Products	4.2
329	Abrasive, Asbestos, and Miscellaneous Nonmetallic Mineral Products	5.2
3312	Blast Furnaces (including coke ovens), Steel Works, and Rolling Mills	130.0
331 (R)[1]	Blast furnaces, Steel Works, and Rolling and Finishing Mills	3.4
3321	Gray iron foundries	100.0
332 (R)[1]	Iron and Steel Foundries	20.0
3334	Primary production of aluminum	58.0
333 (R)[1]	Primary Smelting and Refining of Nonferrous Metals	2.5
334	Secondary Smelting and Refining of Nonferrous Metals	103.0
335	Rolling, Drawing and Extruding of Nonferrous Metals	5.3
336	Nonferrous Foundries	2.7
339	Miscellaneous Primary Metal Products	2.0
341	Metal Cans	11.2
342	Cutlery, Hand Tools, and General Hardware	2.8
343	Heating Apparatus (Except Electric) and Plumbing Fixtures	7.3
344	Fabricated Structural Metal Products	2.8
345	Screw Machine Products, and Bolts, Nuts, Screws, Rivets and Washers	2.9
346	Metal Stampings	6.2
347	Coating, Engraving and Allied Services	1.5
348	Miscellaneous Fabricated Wire Products	3.1
3491	Metal Shipping Barrels, Drums, Kegs and Nails	13.7
349	Miscellaneous Fabricated Metal Products	1.4
351	Engines and Turbines	1.5
352	Farm Machinery and Equipment	0.9
353	Construction, Mining, and Materials Handling Machinery and Equipment	2.2
354	Metalworking Machinery and Equipment	2.9
355	Special Industry Machinery, Except Metalworking Machinery	0.7
356	General Industrial Machinery and Equipment	1.3
357	Office, Computing, and Accounting Machines	0.8
358	Service Industry Machines	1.5
359	Miscellaneous Machinery, Except Electrical	1.4
361	Electric Transmission and Distribution Equipment	0.8
362	Electrical Industrial Apparatus	0.7
363	Household Appliances	2.4
364	Electric Lighting and Wiring Equipment	2.2
365	Radio and Television Receiving Sets, Except Communication Types	0.8

TABLE B-1

Industrial Waste Generation Factors (Continued)

SIC No.	Name	Generation Factor (tons/employee/year)
366	Communication Equipment	1.9
367	Electronic Components and Accessories	1.0
369	Miscellaneous Electrical Machinery Equipment, and Supplies	2.8
371	Motor Vehicles and Motor Vehicle Equipment	2.4
372	Aircraft and Parts	1.2
3731	Ship Building and Repairing	37.0
3732	Boat Building and Repairing	4.1
374	Railroad Equipment	6.2
375	Motorcycles, Bicycles, and Parts	2.9
379	Miscellaneous Transportation Equipment	1.7
381	Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment	1.1
382	Instruments for Measuring, Controlling, and Indicating Physical Characteristics	0.4
383	Optical Instruments and Lenses	0.5
384	Surgical, Medical, and Dental Instruments and Supplies	2.3
385	Ophthalmic Goods	2.6
386	Photographic Equipment and Supplies	0.4
387	Watches, Clocks, Clockwork Operated Devices, and Parts	0.6
391	Jewelry, Silverware, and Plated Ware	0.8
393	Musical Instruments	0.6
394	Toys, Amusement, Sporting and Athletic Goods	1.7
395	Pens, Pencils, and Other Office and Artists' Materials	0.5
396	Costume Jewelry, Costume Novelties, Buttons, and Miscellaneous Notions, Except Precious Metal	0.3
399	Miscellaneous Manufacturing Industries	2.0

1) Includes the waste in the remainder of the 4-digit codes under this 3-digit code.

TABLE B-2

HAUL COST FACTORS

Type of Truck	Capacity, yd^3	Compacted Density lbs/yd^3	Cost of Truck($)	Life of Truck(yr)	Daily Operating Cost ($)	No. in Crew		Wages, $/hr.(3)				Work-Day (Hrs.)	Work-Week (Days)	Haul Cost ($/ton-hr.)	
								Chicago		Downstate					
						Driver	Laborer	Driver	Laborer	Driver	Laborer			Chicago	Downstate
Rear Loading Compactor	16	500	17,175	5	40	1	1	7.19	6.56	5.70	5.10	8	5	5.10	4.36
Rear Loading Compactor (Municipal	25	500	20,772	5	35	1	2	7.19	6.56	5.70	5.10	8	5	4.28	3.66
Rear Loading Compactor (Private)	25	800	30,444	5	35	1	2	7.19	6.56	5.70	5.10	8	5	2.76	2.32
Front Loading Compactor	30	800	42,875	5	40	1	0	7.19	-	5.70	-	8	5	1.35	1.23
Tilt Frame & 13 Containers	42	500	42,325(1)	5	35	1	0	7.19	-	5.70	-	8	5	1.98	1.75
Tractor & 2 Transfer Trailers	75	500	75,800(2)	5	52	1	0	7.19	-	5.70	-	8	6	1.10	1.00*

(1) Includes the cost of the 13 containers.
(2) Includes the cost of the 2 transfer trailers.
(3) Includes fringe benefits.
* $1.40/Ton-Hr. For Vehicles operated 6 hours per day

ASSUMPTIONS FOR HAUL COST CALCULATIONS

Chicago Area

Assumptions:

1. 45% residential, 30% industrial, & 25% commercial solid waste.
2. 50% private and 50% public collection in the residential sector.
3. Only private collection in the industrial and commercial sectors.
4. 24 yd^3 compactor trucks used for residential collection.
5. Tilt-frame trucks used for industrial collection.
6. 30 yd^3 front loading compactor trucks used for commercial collection.
7. 5 loads/day by tilt-frame trucks.
8. 3 loads/day by front loading compactor trucks.

Haul Costs:

1. From collection route to intermediate facility or disposal site, collection vehicles operate 8 hours per day.
2. From intermediate facility to disposal site, vehicles operate 8 hours per day - $1.10/ton-hr.

Downstate

Assumptions:

1. 75% residential, 15% industrial, and 10% commercial solid waste.
2. 50% private and 50% public collection in the residential sector.
3. Only private collection in the industrial and commercial sectors.
4. 25 yd^3 compactor trucks used for residential collection.

5. Tilt-frame trucks used for industrial collection.

6. 30 yd^3 front loading compactor trucks used for commercial collection.

7. 5 loads/day by tilt-frame trucks.

8. 3 loads/day by front loading compactor trucks.

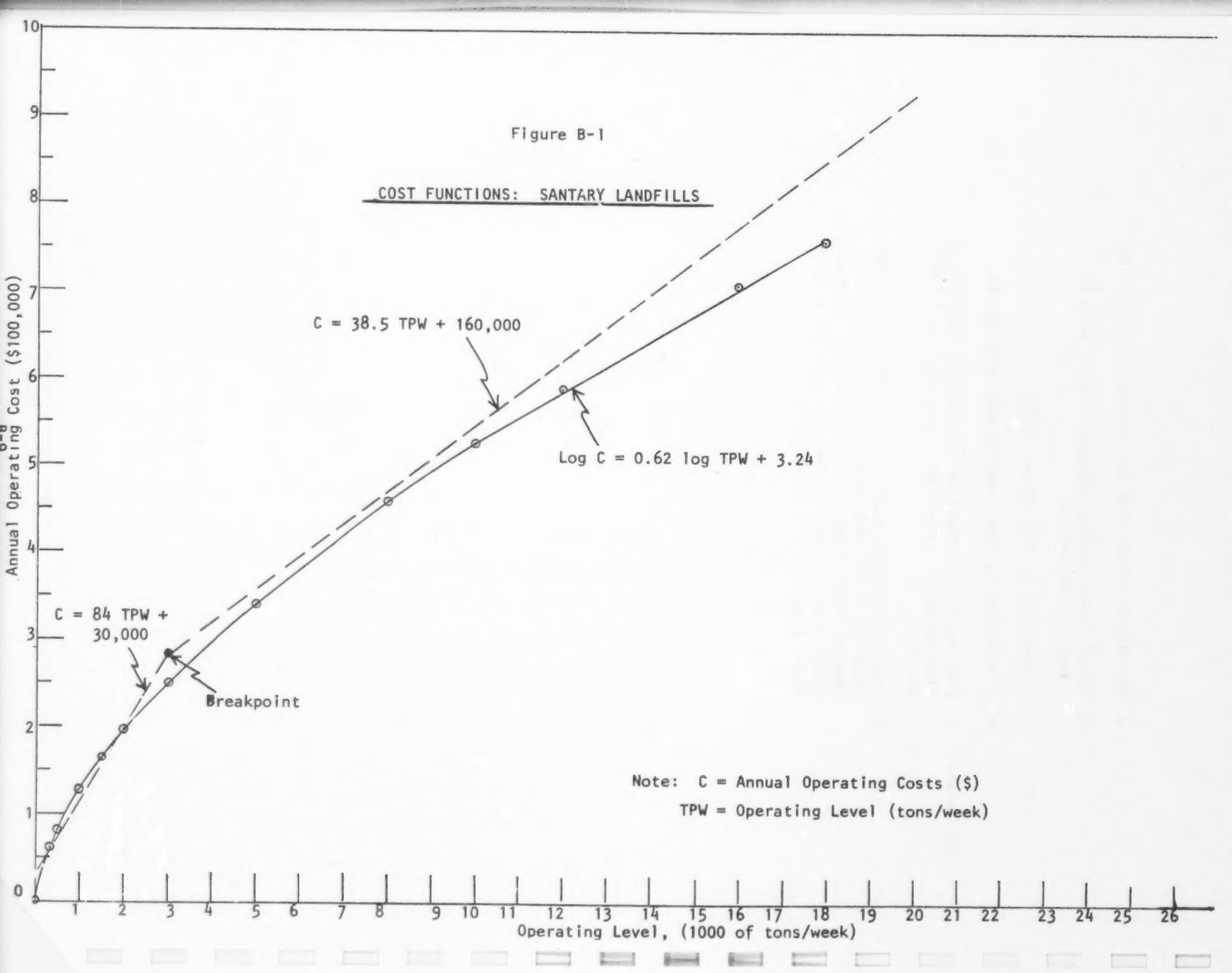
Haul Costs:

1. From collection route to intermediate facility or disposal site, collection trucks operate 8 hours per day.

2. From intermediate facility to disposal site where total loads are less than 150 tons/day, vehicles operate 6 hours per day - $1.40/ton-hr. For total loads greater than 150 ton/day, vehicles operate 8 hours per day - $1.00/ton-hr.

Figure B-1

COST FUNCTIONS: SANTARY LANDFILLS


C = 38.5 TPW + 160,000
Log C = 0.62 log TPW + 3.24
C = 84 TPW + 30,000
Breakpoint
Note: C = Annual Operating Costs ($)
TPW = Operating Level (tons/week)
Annual Operating Cost ($100,000)
Operating Level, (1000 of tons/week)
0 1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

BASIC LANDFILL COST ASSUMPTIONS

TABLE B-3
ASSUMING EXCAVATION DONE BY RENTED OR LEASED UNIT

50 TPW

EQUIPMENT TABLE A

	CAPITAL COST		OWNING		O&M
Farm Tractor & Loader or Blade	$15,000	@ 22%	$3,600	@24%	$3,300
Fuel	500		119		50
	$15,500		$3,719		$3,350

PERSONNEL COST-TABLE B

Supervisor & Operator @ $11.50/Hr. and fringe for 2 days a week - $184./Wk.
$9568./Per Year

FACILITY COST ESTIMATE- TABLE C

		Yr.	CC	@%	AC
1.	Design	25	$ 9,000	8	720
2.	Preparation	25	12,000	8	840
3.	Building Facilities	25	1,000	8	80
4.	Equipment	varies	$15,500		3,719
	Sub-Total		$37,500		
5.	Supervision & Inspection	25	2,510	8	201
	Sub-Total		$40,010		
6.	Contingency 10%	25	4,001	8	320
	Sub-Total		$44,011		
7.	Legal 3%	25	1,320		106
	Sub-Total		$45,331		
8.	Bond Discount 3%	25	1,360		109
	TOTAL CAPITAL COST		$46,691		6095.

ANNUAL COST	
A. Sum of 1-8	$6,095
B. Equipment	3,350
Facility 50% of CC-3	500
Miscellaneous 3% of CC-2	360
C. Salaries	9,568
Overhead	
Total Annual Cost	$19,873
Annual Cost/Ton	$ 7.64
@ 52 Weeks	
@ 50 TPW	

O&M- OPERATION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-4

BASIC LANDFILL COST FUNCTION ASSUMPTIONS

100 TPW

EQUIPMENT TABLE A

	CAPITAL COST	OWNING	O&M
Tractor & Loader or Blade	$15,000	24% $3,600	30% $4,500
Fuel	500	119	50
	$15,500	$3,719	$4,550

PERSONNEL COST TABLE B

Supervisor and Operator @ $11.50/Hr. include Fringe for 4 days a week - $19,136

FACILITY COST ESTIMATE TABLE C

		YR	CC	@%	AC
1.	Design	25	$10,000	8	$ 800
2.	Preparation	25	13,000	8	1,040
3.	Building Facilities	25	1,000	8	80
4.	Equipment	varies	15,500		3,719
	Sub-Total		$39,500		
5.	Supervision & Inspection	25	3,020		242
	Sub-Total		$42,520		
6.	Contingency - 10%	25	4,252		340
	Sub-Total		$46,772		
7.	Legal 3%	25	1,403		112
	Sub-Total		$48,175		
8.	Bond Discount 3%	25	1,445		116
	TOTAL CAPITAL COST		$49,620		$6,449

ANNUAL COST	
A. Sum of 1-8	$ 6,449
B. Equipment	$ 4,550
Facility 50% of CC-3	500
Miscellaneous 3% of CC-2	390
C. Salaries	$19,136
Total Annual Cost	$30,975
Annual Cost/Ton @ 52 Weeks @ 100 Tons	$5.96

O&M- OPERTION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-5

BASIC LANDFILL COST ASSUMPTIONS

250 TPW

EQUIPMENT TABLE A

	YEAR	CAPITAL COST	%	OWNING	%	O & M
Crawler	5	$36,000	24	$8,546	22	$8,000
Fuel	5	500	24	119		50
		$36,500		$8,665		$8,050

PERSONNEL COST TABLE B

		ANNUAL
1 Laborer $4/Hr.- 2080	Fringes	$8,320
1 Operator & Supervisor $11.50/Hr - 2080	"	24,000
		$32,320

FACILITY COST ESTIMATE TABLE C

		Yr.	CC	@%	AC
1.	Design	25	$11,000	8	$ 880
2.	Preparation	25	14,000	8	1,120
3.	Building Facilities	25	1,000	8	80
4.	Equipment	varies	36,500		8,665
	Sub-Total		$62,500		
5.	Supervision & Inspection 2% of 4 10% of 1-3	25	3,330	8	266
	Sub-Total		$65,830		
6.	Contingency 10%	25	6,583	8	527
	Sub-Total		$72,413		
7.	Legal 3%	25	2,172	8	174
	Sub-Total		$74,585		
8.	Bond 3%	25	2,238	8	179
	TOTAL CAPITAL COST		$76,823		$11,891

ANNUAL COST

A.	Lines 1-8	$11,891
B.	Equipment	8,050
	Facility 50% of CC-3	500
	Miscellaneous 3% of CC-2	420
C.	Salaries	$32,320
	Total Annual Cost	$53,181
	Annual Cost/Unit	$ 4.13/Ton

O&M- OPERATION AND MANTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-6

BASIC LANDFILL COST ASSUMPTIONS

500 TPW

EQUIPMENT - TABLE A

	YEAR	CAPITAL COST	%	OWNING	%	O&M
Crawler 195Hp	5	$58,000	24	$13,779	24	$13,800
Fuel	5	800		190		100
Scales	10	$ 7,500	14	1,019	8	600
		$66,300		$14,988		$14,500

LABOR TABLE B

Supervisor Scale Man $4/Hr. $5/Hr.	$11,000
Operator @ $11.50 for 2080 Hr.	24,000
Laborer $4.00/Hr. for 2080 Hr.	8,320
	$4 ,320

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	AC
1.	Design	25	$15,000	8	$ 1,173
2.	Preparation	25	20,000	8	1,565
3.	Building Facilities	25	8,000	8	640
4.	Equipment	Varies	66,300		14,988
	Sub-Total		$109,300		
5.	Supervision & Inspection	25	5,626	8	450
	Sub-Total		$114,926		
6.	Contingency 10%	25	11,493	8	919
	Sub-Total		$126,419		
7.	Legal 3%	25	3,793	8	303
	Sub-Total		$130,212		
8.	Bond Discount 3%	25	3,906	8	312
	TOTAL CAPITAL COST		$134,118		$20,350

ANNUAL COST	
A. Line 1-8	$20,350
B. Equipment	14,500
Facility ≈50% of CC-3	3,500
Miscellaneous 3% of CC-2	600
C, Salaries	43.320
Total Annual Cost	82,370
Annual Unit Cost	$3.16/Ton

O&M- OPERTION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-7

BASIC LANDFILL COST ASSUMPTIONS
1000 TPW

EQUIPMENT - TABLE A

	YR.	CC	%	OWNING	%	OPERATION & MAINTENANCE
1 115Hp Crawler	5	$ 36,000	24	$ 8,546	22	$ 8,000
1 170Hp Crawler	5	52,000	24	12,345	22	12,000
1 Fuel Port	5	3,000	24	712	7	200
Scales	10	10,000	14	1,359	10	1,000
		$101,000		$22,962		$21,200

PERSONNEL - TABLE B

Super & Scalemen	1	@ 2080 Hr. @ $8.17/Hr.	$17,000
Equip. Oper. 1.5	1.5	$24,000/Year	36,000
Labor	2		16,640
			$69,640

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	A.C.	ANNUAL COST	
1.	Design	25	$ 17,500	8	$1,369		
2.	Preparation	25	25,000	8	1,956	A. Line 1-8	$29,611
3.	Building Facilities	25	8,000	8	640		
4.	Equipment	Varies	101,000	-	22,962	B. Equipment	21,200
	Sub-Total		$151,500			Facility 50% of CC-3	4,000
5.	Supervision & Inspection	25	7,070	8	566	Miscellaneous 3% of CC-2	750
	Sub-Total		$158,570				$55,561
6.	Contingency 10%	25	15,857	8	1,269	C. Salaries	69,640
	Sub-Total		$174,427				
7.	Legal 3%	25	5,233	8	418		
	Sub-Total		$179,660				
8.	Bond Discount 3%	25	5,390	8	431	Total Annual	$125,201
	TOTAL CAPITAL COST		$185,050		$29,611	Annual Unit Cost at 962 T/W at 52 W/Yr.	$2.50/Ton

O&M- OPERATION AND MAINTENANCE
Yr,- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-8

BASIC LANDFILL COST ASSUMPTIONS

2000 TPW

EQUIPMENT TABLE A

	YR.	CAPITAL COST	%	OWNING	%	O&M
Crawler 195 Hp.	5	$ 58,000	24	$13,770	24	$13,800
Crawler 300 Hp.	5	86,000	24	20,417	22	19,000
Front End Loader 100 Hp.	5	31,000	24	7,360	19	6,000
Fuel Supply	5	5,000	24	1,187	8	400
Scale	10	11,000	14	1,495	14	1,500
		$191,000		$44,229		$40,700

PERSONNEL COSTS TABLE B

Supervisor & Scale	1 @ 2080 @ $8.2/Hr.	$17,056
Laborer	2 @ 2080 @ $4./Hr.	16,640
Equip. Operator	2.5 @ $11.50/Hr and 2080 Hrs.	59,800
		$93,496

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	AC
1.	Design	25	$20,000	8	$ 1,565
2.	Site Preparation	25	30,000	8	2,347
3.	Building Facilities	25	21,620	8	1,691
4.	Equipment	Varies	191,000	-	44,229
	Sub-Total		$262,620		
5.	Supervision & Inspection	25	10,982	8	879
	Sub-Total		$273,602		
6.	Contingency - 10%	25	27,360	8	2,189
	Sub-Total		$300,962		
7.	Legal 3%	25	9,029	8	722
	Sub-Total		$309,991		
8.	Bond Discount 3%	25	9,299	8	744
	TOTAL CAPITAL COST		$319,290		$54,366

ANNUAL COST

A. Lines 1-8	$54,366
B. Equipment	40,700
Facility 50% of CC-3	10,810
Miscellaneous 3% of CC-2	900
C. Salaries	93,496
Total Annual Cost	$200,272
Annual Unit Cost	$2.00/Ton

O&M- OPERATION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC- ANNUAL CAPITAL RECOVERY VALUE

Table B-9

BASIC LANDFILL COST ASSUMPTIONS

5000 TPW

EQUIPMENT TABLE A

NO.	YR.	CAPITAL COST	%	OWNING	%	O&M
1. Crawler 195Hp.	5	$ 58,000		$13,770		$13,800
2. Crawler 300Hp.	5	86,000		20,417		19,000
170Hp.	5	52,000		12,345		12,000
1. Loader 300Hp.	5	31,000		7,360		6,000
1. Scraper 150Hp.	5	49,000		11,633		18,000
1. Truck Pick-Up	4	4,000	29	1,160	46	1,840
1. Fuel Truck	5	13,000	24	3,086	35	4,500
1. Water Tank Truck	5	12,000	24	2,849	35	4,000
Motor Grador	5	31,000	24	7,360	13	4,000
Scale	10	25,000		3,397		3,000
		$361,000		$83,377		$86,140

PERSONNEL COSTS TABLE B

5 Operators @ $11.50/Hr. @2080	$120,000	
4 Laborer $4.00/Hr.	33,280	
2 Scale Operator @ $11066./Year	22,132	Based on Ratio of Lab/Sc.Op.
1 Supervisor @ $17,000 @ $8.2/Hr.	17,000	Based on Ratio of Sc. Op/Sup.

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	AC
1.	Design	25	$ 25,000	8	$ 1,956
2.	Preparation	25	40,000	8	3,129
3.	Building Facilities	25	27,244	8	2,131
4.	Equipment	Varies	361,000	-	83,377
	Sub-Total		$453,244		
5.	Supervision & Inspection	25	16,444		1,316
	Sub-Total		469,688		
6.	Contingency 10%	25	46,969		3,758
	Sub-Total		$516,657		
7.	Legal 3%	25	15,500		1,240
	Sub-Total		$532,157		
8.	Bond Discount 3%	25	15,965		1,277
			$548,122		$98,184

O&M - OPERATION AND MAINTENANCE
Yr. - NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST

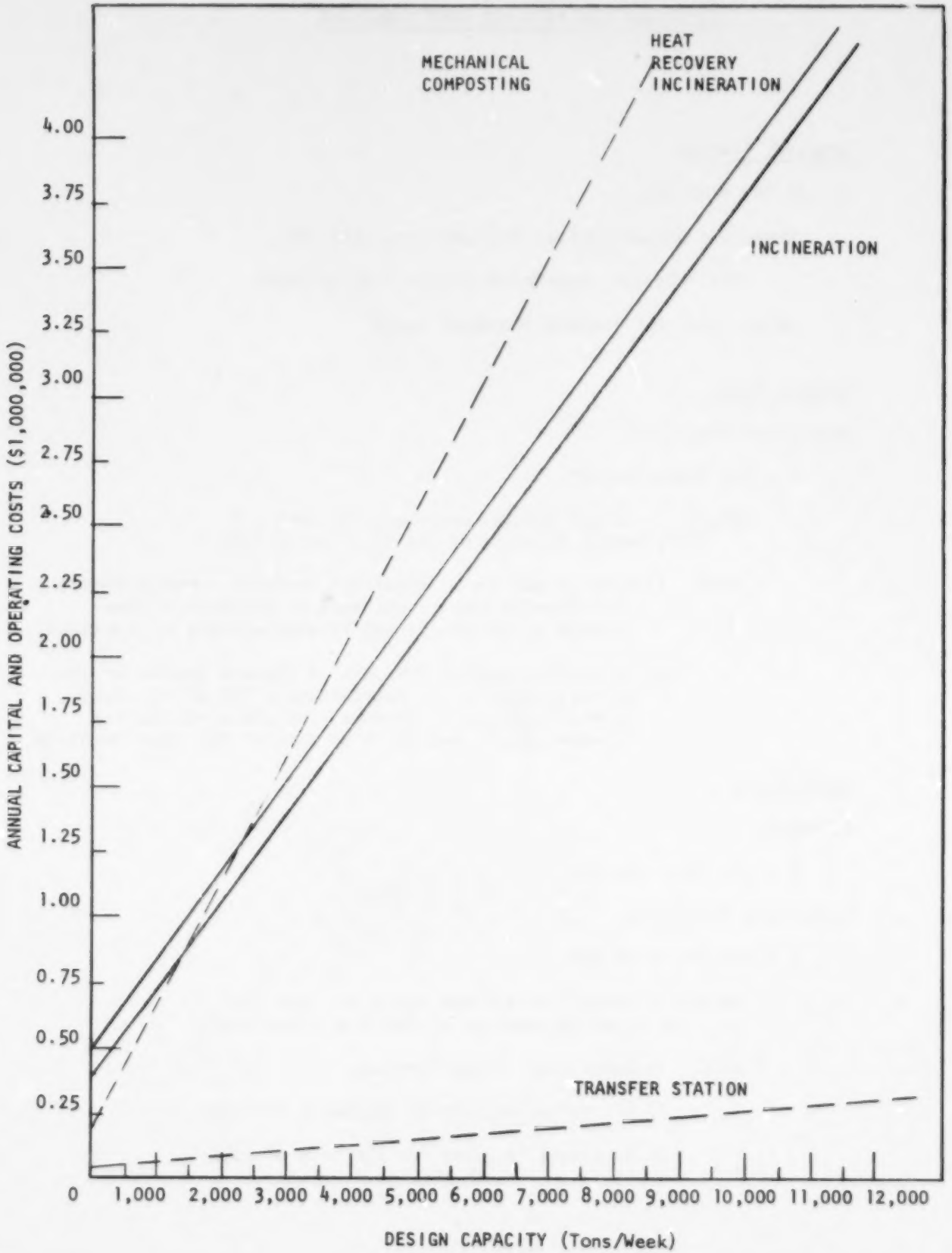
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-9 Continued

A.	Sum 1-8	$98,184
B.	Equipment	86,140
	Facility	13,622
	50% of CC - 3 Miscellaneous	1,200
	3% of CC - 2	
C.	Salaries	$192,412
	Annual Cost	$391,558
	Annual Unit Cost	$1.50/Ton

Figure B-2

COST FUNCTIONS: INTERMEDIATE PROCESSING FACILITIES



EQUATIONS FOR FACILITY COST FUNCTIONS

Transfer Station

$C = 22\ TPW + 40{,}000$

Where C = Annual capital and operating cost ($)

TPW = Design capacity of facility (tons/week)

NOTE: Does not include transport costs.

Compost Plant

Mechanical Digestion:

$C = 500\ TPW + 200{,}000$

Where C = Annual capital and operating cost ($)
TPW = Design capacity of facility (tons/week)

NOTE: 1) Cost of residue disposal not included. Approximately 15% of solid waste input must be disposed of when salvage is not practiced; 5% when salvage is practiced.

2) No credit is given for sale of the end product or the salvaged materials. Approximately 33% of the input quantity emerges as compost, and glass and ferrous salvage usually amount to 5% each of the input quantity.

Incinerator

Standard:

$C = 320\ TPW + 400{,}000$

With Power Production

$C = 340\ TPW + 500{,}000$

Where C = Annual capital and operating cost ($)
TPW = Design capacity of facility (tons/week)

NOTE: 1) Continuous - feed furnaces

2) Air pollution control equipment included

3) No credit is given for the sale of power

Sanitary Landfill

Capital Cost: Consultant's estimate for each individual case.

Operating Cost:

$C = 84\ TPW + 30{,}000$ when $TPW \leq 3{,}000$
$C = 38.5\ TPW + 160{,}000$ when $TPW > 3{,}000$

Where C = Annual operating cost ($)
TPW = Operating level (tons/week)

The curve that best fit the cost data is described by the following equation:

$$C = 0.62 \log TPW + 3.24$$

Since only linear equations are acceptable to the optimization routine, two linear equations were fitted to the curve aroung the specified breakpoint which yielded the two linear equations above.

RESOURCE RECOVERY FACILITY AND COST

The following system was designed to process up to 750 tons per day of municipal solid waste based upon a 2-shift operation. The system will shred all waste, magnetically separate ferrous metals and separate heavy and light fractions. Two shredders are provided to assure continuous service. The system will produce: shredded fuel, ferrous metals, and a mixture of glass and non-ferrous metals.

This estimate does not include the power plant handling and transportation costs. Included in the building cost is a pile foundation.

This system was designed in 1973 for the City of New Orleans by the National Center for Resource Recovery, but has not been constructed. The construction and operating costs included herein are unvarified estimates of cost.

TABLE B-10

FACILITY (750 Tons/Day, 2 Shift)

	MATERIALS	LABOR
Scale	57,375	6,715
Front End Loader	58,300	-
Municipal Solid Waste Conveyor System	201,235	14,740
Reject Bin (large objects)	6,985	-
Trommel Screen	143,185	11,120
Trommel Discharge Conveyor	12,445	19,085
Shredder Feed Conveyor	20,005	19,085
Shredder (2)	569,615	18,790
Shredder Discharge Conveyor	45,545	805
Air Classifier	270,960	42,190
Magnetic Separator	28,000	7,000
By-pass Conveyor	25,380	2,115
Shredder Materials Conveyor System	58,235	2,115
Heavy Materials Conveyor System	25,875	4,935
Electrical System	51,650	10,075
	$1,574,890	$158,770
Building, Receiving (1,000 Ton Storage)	182,880	14,590
Asphalt Apron	14,750	12,010
Shredder Building	113,305	79,500
	$ 310,935	$106,100
Engineering, Contingencies, Profit	510,385	
Total Cost	$2,661,080	

TABLE B-10 (Continued)

OPERATING COST

Amortization (10 Years @ 8%)	
2,661,080 (CRF 10 Years @ 8%) 0.149 ÷ 12 =	45,500
Power, water	14,538
Shredding	23,469
Recovery	28,608
Cost per Month	$112,015

Total Annual Cost $1,340,000

750 Tons/Day x 6 Day/Week x 52 Weeks/year = 234,000 Tons/Year

Cost per Ton = $5.73

@ 500 Tons/Day x 312 Days/Year = 156,000 Tons

Cost Per Ton = $8.60